A FIELD GUIDE TO THE ANTS OF NEW ENGLAND

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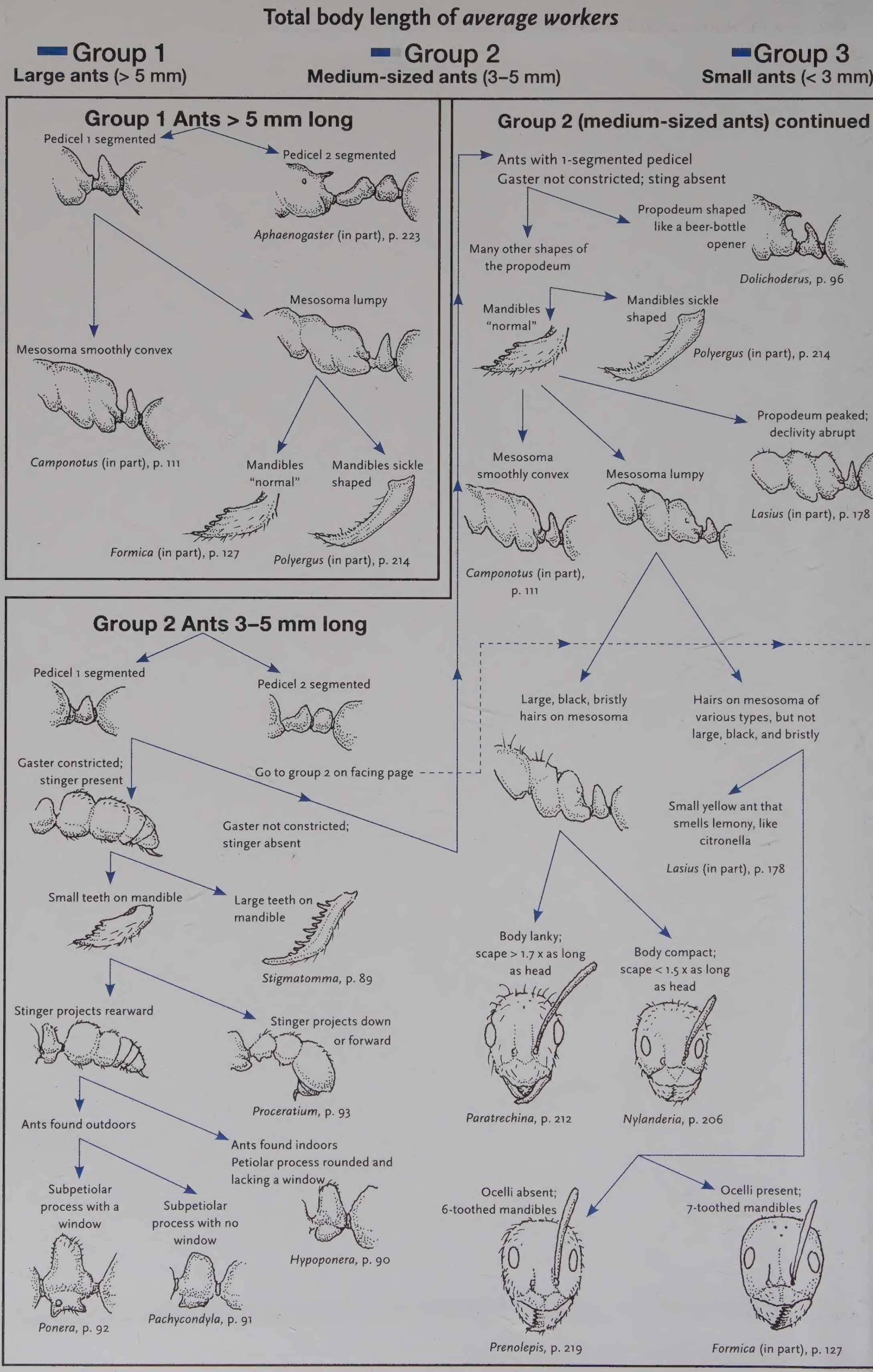
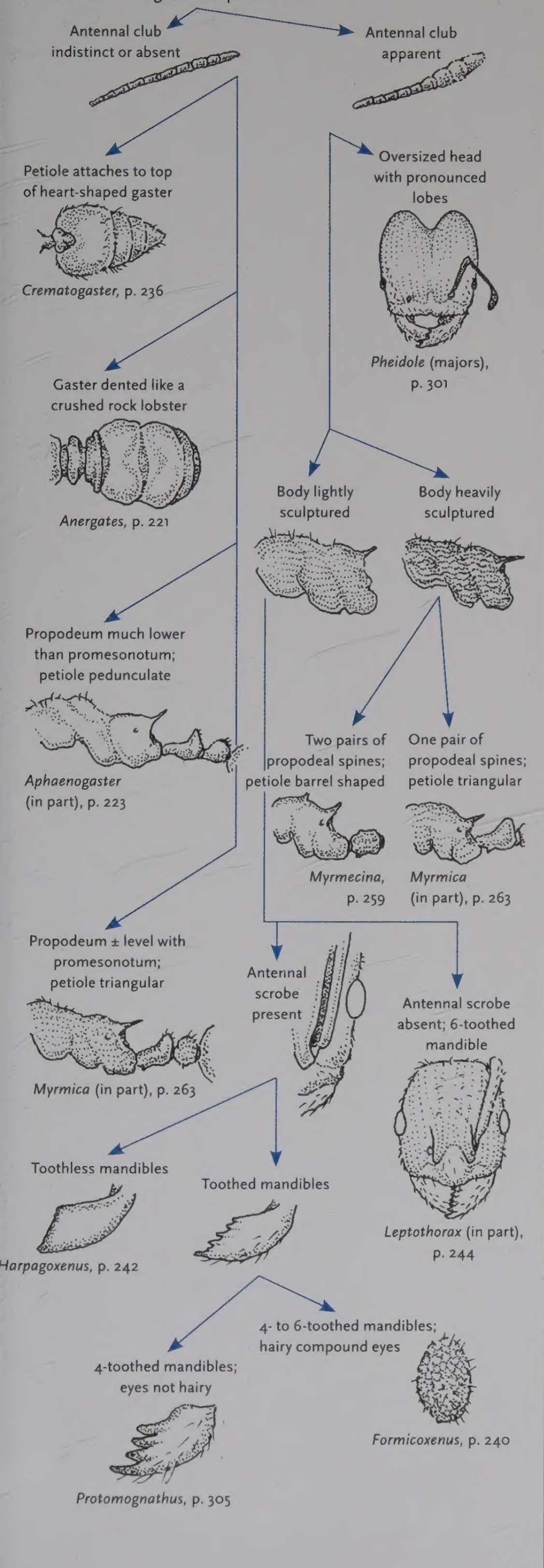


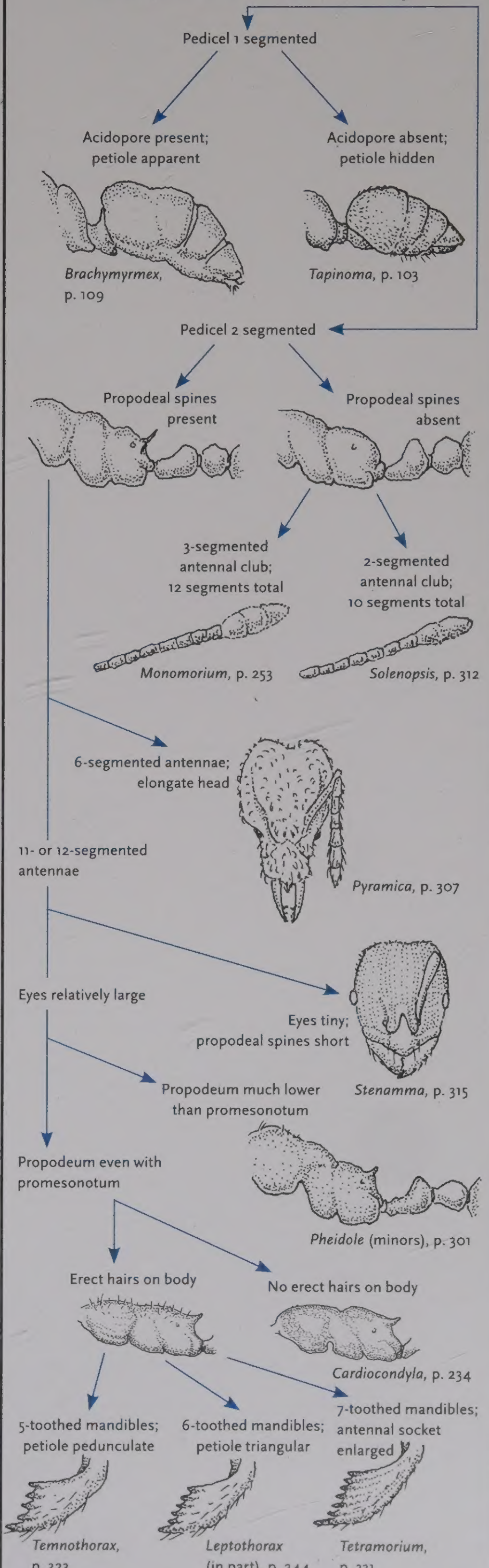
Total body length of average workers
Group 1
Large ants (> 5 mm)
Group 2
Medium-sized ants (3–5 mm)
Group 3
Small ants (< 3 mm)
Group 1 Ants > 5 mm long
Pedicel 1 segmented
Pedicel 2 segmented
Aphaenogaster (in part), p. 223
Mesosoma smoothly convex
Camponotus (in part), p. 111
Mesosoma lumpy
Mandibles "normal"
Mandibles sickle shaped
Formica (in part), p. 127
Polyergus (in part), p. 214
Group 2 Ants 3–5 mm long
Pedicel 1 segmented
Pedicel 2 segmented
Go to group 2 on facing page
Gaster constricted; stinger present
Gaster not constricted; stinger absent
Small teeth on mandible
Large teeth on mandible
Stigmatomma, p. 89
Stinger projects rearward
Stinger projects down or forward
Proceratium, p. 93
Ants found outdoors
Ants found indoors
Petiolar process rounded and lacking a window
Hypoponera, p. 90
Subpetiolar process with a window
Subpetiolar process with no window
Ponera, p. 92
Pachycondyla, p. 91
Group 2 (medium-sized ants) continued
Ants with 1-segmented pedicel
Gaster not constricted; sting absent
Propodeum shaped like a beer-bottle opener
Dolichoderus, p. 96
Many other shapes of the propodeum
Mandibles "normal"
Mandibles sickle shaped
Polyergus (in part), p. 214
Propodeum peaked; declivity abrupt
Lasius (in part), p. 178
Mesosoma smoothly convex
Camponotus (in part), p. 111
Mesosoma lumpy
Large, black, bristly hairs on mesosoma
Hairs on mesosoma of various types, but not large, black, and bristly
Small yellow ant that smells lemony, like citronella
Lasius (in part), p. 178
Body lanky; scape > 1.7 x as long as head
Body compact; scape < 1.5 x as long as head
Paratrechina, p. 212
Nylanderia, p. 206
Ocelli absent; 6-toothed mandibles
Ocelli present; 7-toothed mandibles
Prenolepis, p. 219
Formica (in part), p. 127

Group 2 (medium-sized ants) continued

Ants with 2-segmented pedicel



Group 3 Ants < 3 mm long



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To everyone who wants to learn more about the ants that share our planet

I spent long hours with them [the nation of ants], *and yet did not get bored. They would come and give us hope that life had not come to a halt.*

—Ahmed Errachidi, from *A Handful of Walnuts*

Contents

Preface

Why ants, why New England, why a field guide? For the past three years, we have repeatedly been asked these questions. The short answers are: ants are important, fascinating, and cool; New England is where we live, work, and play; and field guides bridge the gap between ant farms and technical keys and encourage everyone to look more closely at what Professor E. O. Wilson calls the "little things that run the world." But now that this field guide is in front of you, you deserve some more detailed answers.

Ants are fascinating animals and are familiar to people around the world. Yet most people know little or nothing about their diversity, natural history, ecology, or evolution. What are these ants? How many different kinds are there? What do they eat? Before we wrote this book, most of our parents, nieces, nephews, students, friends, and colleagues had no idea that there are over 130 species of ants in New England alone! Now they know better.

Ants are some of the most important actors in the ecological theater (see Chapter 2). In many places, ants make up the largest proportion of animal biomass. If you put all the ants on one side of a scale and all of the animals (including humans) of any other kind on the other, ants most likely would be heavier. They eat animals (dead or alive), plants, and fungi; disperse seeds; and turn over more soil than earthworms. They are everywhere: inside and outside, in the soil of forests and meadows, in and on trees, under the sink and in the rafters, and in between the cracks in the pavement. Aspects of our own human societies are mirrored in ant societies. Workers cooperate and divide up labor within colonies, but different colonies fight for food and space, battle over territories, and even parasitize or enslave one another. This is not always a mirror into which we want to look, however; their lives and behaviors have been caricatured in many books and movies, from H. G. Wells's *Empire of the Ants* (1905) through Gordon Douglas's *Them* (1954) to Eric Darnell and Tim Johnson's *Antz* (1998). Because ants are important, fascinating, and cool, we set out to write a book for people interested in learning more about them and their world.

Ants occur on every continent except Antarctica and in habitats ranging from the Arctic tundra to dry deserts and tropical rainforests. Ants live where people are and where they have been, including rural villages, suburban towns, and densely populated cities, as well as in abandoned mines and overgrown vacant lots. New England is a manageable microcosm of the larger world. We divide the region politically into six states—Maine,

New Hampshire, Vermont, Massachusetts, Connecticut, and Rhode Island—but ants, like Boston Red Sox fans, show little respect for state boundaries. Instead, ants are tied to ecoregions: coastal plains with their beaches, dunes, and pine barrens; upland coniferous, deciduous, and mixed forests; the farm fields and old fields in between; and the wetlands, rivers, lakes, and streams that connect all of these habitats (see Chapter 1). This range of habitats and the variable climate of New England are similar to those of much of the eastern United States and Canada, so the utility of this guide extends well beyond New England. In the descriptions of individual species (Chapter 5), we include over a dozen species that currently reach the edges of their range on New England's borders in Canada and New York. As the climate changes, some of these may make their way into New England itself.

Ants, like birds, butterflies, and dragonflies, are enchanting to observe in the field and are downright spectacular when viewed through a hand lens or a dissecting microscope. The ant fauna of New England displays a stunning variety of sizes, colors, sculpturing, armor, ornamentation, and hairiness. In brief, ants are beautiful. The creations of advertisers, computer graphics artists, cinematographers, and toy makers often are inspired by ants, and it is aesthetically pleasing to study their features at the same time that we identify them. In this guide, we celebrate such beauty. At the same time, we have designed this book for beginners first learning how to identify ants and for the experts who make their living studying them.

With only a little background and practice, and a hand lens, amateur naturalists, teachers, and students of all ages can learn to identify the common groups (genera) of ants. In fact, the illustrated key to the genera printed on the inside front cover of this field guide is designed to be used while observing ants with a 10x hand lens—no microscope required! The modest diversity of New England ants (just over 130 species in 31 genera and 6 subfamilies) makes them practical subjects for studies of biodiversity and conservation in the classroom and the field. It can be hard to determine the precise identity of an ant in the field because they are small. However, accurate species identification of pinned specimens under a dissecting microscope is easier because ants have distinctive features visible on their bodies. It is easy to distinguish among many ants once you know what to look for. With this guide, anyone can learn the manageable group of New England ants.

Ant species are identified by using keys (see Chapters 4 and 5). The first comprehensive key to all of the ants of North America was published in 1950, has never been revised, and is now out of print. A complete key to the genera of North American ants was published only in 2007. Before we wrote this book, the identification of ant species from any particular region

would require dozens of specialized keys that were published in obscure journals and that contained only a few line drawings illustrating the most important features or characteristics. Many of these keys could be deciphered and used only after you already knew how to identify the species!

Using identification keys is an exercise in deduction, but it need not be an exercise in frustration. Although scientists have developed specialized vocabularies for each group of organisms and myrmecologists (literally, "students of ants") have developed their own arsenal of distinctive terms, our keys use relatively simple language, and all terms are illustrated (see Chapter 4 and the diagrams printed on the inside back cover). The keys themselves are copiously illustrated: over 500 original drawings (both black-and-white and color) greatly aid their use. Each species is described on its own page, with additional drawings and color photographs taken in the field of the workers, their nests, and their habitats. Simple maps illustrate where in New England each species has been collected through 2011.

The world's climate is changing rapidly, and New England is changing, too. Ants will respond to these changes: southern species may move northward into New England, and northern species may take refuge on high mountain peaks or emigrate to Canada. This book not only provides an introduction to the tools and techniques of observing and collecting ants (Chapter 3) but also summarizes the current (as of 2012) patterns of species distributions (see the maps in Chapter 5 and the discussion in Chapter 6). Your observations will help test hypotheses about how the distributions of ants will change as the climate changes. The data associated with the species' distribution maps and the analysis of their distribution are publicly available at the book's Web site (http://NEants.net). Although ants have been collected in many New England parks and towns, many other locations are entirely unexplored. Go outside, explore the forests and fields, learn about the ants, and add to this growing body of data. Together, we will continue to learn about the world of ants.

Acknowledgments

It is a cliché to say that it takes a village (or at least an anthill) to write a book, but it is really true for a book that brings together so much knowledge of natural history, taxonomy, ecology, and evolutionary biology in one place. First and foremost, we thank Stefan Cover and André Francoeur, myrmecologists extraordinaire, who spent countless hours teaching us the intricacies of New England ant taxonomy and sharing their lifetimes of expertise with us. James Trager brought us up to speed on *Polyergus* taxonomy, and Bernice DeMarco shared her evolving ideas about the subtle differences among *Aphaenogaster* species. The keys have been tested and the text critiqued by Stefan, André, and James, along with many other of our students and colleagues: Katie Bennett, David Cappaert, Israel Del Toro, Mark Deyrup, Richard Haradon, Clarisse Hart, Michael Kaspari, Dave McDonald, Mike and Shannon Pelini, Alex Wild, and two anonymous reviewers, along with all of the participants in the 2011 Humboldt Field Research Institute Seminar on the Ants of New England: Jennifer Apple, Amy Arnett, Sharon Bewick, Rob Chapman, Rob Clark, Aaron Fairweather, Jonathan Mays, Juan Sanchez, Tony Scalise, Rogério Silva, and Conrad Vispo. They found many mistakes and unclear couplets in our draft keys; we take responsibility for any errors that remain.

The authors shared in the writing and editing of the entire book. All of the illustrations were drawn from New England specimens by coauthor Elizabeth Farnsworth. Yale University Press scanned the drawings for the book; the originals are stored in the Harvard Forest Archives in Petersham, Massachusetts. Most of the photographs were taken by coauthors Gary Alpert and Aaron Ellison; additional photographs were contributed by Adam Clark, Elaine and Julius Ellison, Elizabeth Farnsworth, André Francoeur, Nick Gotelli, Benoit Guénard, Rick Hawkins, Sara Lewandowski, Billie Jean Moran, Tom Murray, Claude Pilon, Mike Quinn, Thomas Shahan, Alex Wild, and the Yale Peabody Museum. Each photograph in the book is imprinted with the initials of the photographer; refer to the Internet Resources at the end of the book for a list of Web sites where you can enjoy more fine photography by Tom, Claude, Mike, Thomas, and Alex. (The aerial photograph of the Thimble Islands on p. 296 is © Peabody Museum of Natural History, Yale University, New Haven, Connecticut.) Ed Kamens showed Aaron Ellison around Yale's Saybrook College to photograph the only New England habitat of *Paratrechina longicornis* known to date, and Shirley Ellison spent a day with Aaron locating *Nylanderia flavipes* to photograph in the field. Brian Hall (Harvard Forest) helped us with some of the mapping. Donat Agosti (American Museum of Natural History), Barry Bolton (British Museum of

Natural History), and Ivy Livingston (Harvard Department of the Classics) taught us more about nouns in apposition than we ever knew we needed to know. Jean Thomson Black, executive editor at Yale University Press, has encouraged and supported this project from its inception; her editorial assistant, Sara Hoover, has answered seemingly endless queries and handled the day-to-day processing of the images and the manuscript. Marilyn Martin of Princeton Editorial Associates thoroughly and carefully edited the entire manuscript, catching subtle errors and greatly improving the text. Peter Strupp and his other colleagues at Princeton Editorial Associates and Nancy Ovedovitz, Lindsey Voskowsky, and Jenya Weinreb in the design and production group at Yale University Press have produced a book that is as much a joy to look at as we hope it is to read.

Although all of us have been watching and studying ants for many years, we can trace the genesis of this particular book to a statewide ant-collecting blitz we conducted across Massachusetts in 2007 on properties owned by the Massachusetts Audubon Society (MAS) and The Trustees of Reservations (TTOR). Taber Allison (MAS), Robert Buchsbaum (MAS), Paul Goldstein (Field Museum, Chicago), Russ Hopping (TTOR), Julie Richburg (TTOR), and Ernie Steinauer (MAS) provided encouragement and logistical support for that study. The Universities of Connecticut (UCMS), Maine (UMDE), Massachusetts (UMEC), New Hampshire (UNHC), Rhode Island (URIC), and Vermont (UVCC), along with Cornell University (CUIC), Pennsylvania State University (PSUC), Acadia National Park, the Maine Forest Service (ELMF), the American Museum of Natural History (AMNH), the Academy of Natural Sciences (ANS), Harvard's Museum of Comparative Zoology (MCZ), the Yale Peabody Museum (PMNH), and the Canadian National Collection of Insects (CNC), opened their collections to us, allowing us to accumulate tens of thousands of historical records of ant occurrences. We are grateful to the faculty and curators at these institutions, not only for helping us access the collections but also for doing such a great job curating them: Rebecca Cole-Will (Acadia National Park); Andy Bennett, Gary Gibson, and John Huber (CNC); Rick Hoebeke (CUIC); Charlene Donohue (ELMF); Stefan Cover (MCZ); Ray Pupedis (PMNH); Jane O'Donnell and Dave Wagner (UCMS); Frank Drummond and Ellie Groden (UMDE); Don Chandler (UNHC); Howie Ginsberg (URIC); and the late Kurt Pickett (UVCC). Charlene Donohue, forest entomologist with the state of Maine and president of the Maine Entomological Society, rounded up specimens from the Maine State collections, those of David Bourque and Dana Michaud, and many more from other members of the society; she, along with Amy Arnett (Unity College, Maine), Beth Choate (University of Maine), Richard Haradon (Essex, Massachusetts), Daniel Jennings (University of Maine), Andrew McKenna-Foster (Maria Mitchell Natural History Museum, Nantucket,

Massachusetts), Mark Mello (the Lloyd Center for the Environment, Dartmouth, Massachusetts), Joan Milam (University of Massachusetts), Beetle Bob Nelson (Colby College), Joe Simonis (Cornell University), and Scott Smyers (Oxbow Associates, Massachusetts), sent us ants—sometimes tens of thousands of them—to identify; and Chelsea Carr, Israel Del Toro, Terrance Dunn, Clarisse Hart, Samantha Hilerio, Mark Johnston, Kelly McBride, Dave McDonald, Mike Pelini, and Rogério Silva cheerfully sorted and helped to identify them. Eldridge Adams (University of Connecticut) sent us his unpublished distributional records for *Myrmica rubra*, and Gary Ouellette (College Park, Maryland) sent us unpublished collection records for Kennebec County, Maine. We especially thank Israel Del Toro, who created a unified database of all of the aforementioned specimens, along with thousands more he collected himself from Virginia to Maine in 2010. These data are part of his Ph.D. dissertation work at the University of Massachusetts, and we are grateful that he shared the database with us so we could construct accurate distribution maps. Dave Lubertazzi (MCZ), Rogério Silva (University of São Paulo), and Michael Weiser (North Carolina State University) contributed additional georeferenced data from the MCZ to Israel's database.

Finally, nothing in this world happens for free. Our research on ants has been generously supported by the Arthur Green Fund of the MCZ, the Conservation and Research Foundation, MAS, the Massachusetts Natural Heritage and Endangered Species Program, the Nantucket Conservation Foundation, TTOR, the U.S. Department of Energy (award DE-FG02-08ER64510), and the U.S. National Science Foundation (awards DEB 02-35128, DBI 04-52254, DEB 05-41680, DEB 06-20443, and DBI 10-03938). To all, we are grateful.

A Field Guide to the Ants of New England

1.

Ants and the New England Landscape

New Englanders live in a changeable climate. Locals quip, "If you don't like the weather, wait ten minutes." But we don't always appreciate how diverse our landscape is. We lack the grand mountains of western North America (our tallest, Mount Washington, is just over 2,000 m high), and it may seem to the casual observer that New England is one large suburb from Portland, Maine, to Fairfield, Connecticut. But from an ant's-eye view, even a change in elevation of only 100 m or a shift in latitude of only 1° (about 110 km) can determine whether a nest can survive. Subtle differences in soil texture, bedrock chemistry, moisture, and temperature all make a huge difference to an ant. To better understand our ants, we start by introducing you to the geological and environmental diversity of New England.

Ancient History Shapes Today's Environment

New England gardeners grumble that their soils are a messy jumble of rocks, but they rarely consider where those rocks came from. The bedrock of New England is the product of hundreds of millions of years of geological drama involving continental collisions, mountain building, glacial scouring, and other upheavals. Our oldest rocks date back over 1 billion years, visible in the Grenville gneiss outcrops on Clarksburg Mountain in the southern Green Mountains of western Vermont. Common bedrock types in New England include the familiar hard, acidic granites of New Hampshire and Maine (remnants of the European tectonic plate that pulled away 200 million years ago with the breakup of the supercontinent Pangaea); the volcanic redstones and basalts of west-central Massachusetts and Connecticut (the >200-million-year-old Metacomet Range); marbles and limestones from 500-million-year-old beaches and reefs in valleys of western Massachusetts and Vermont; and the much older, highly metamorphic gneisses and schists of the Berkshire and Taconic Mountains. The composition of the bedrock profoundly influences the chemistry and texture of the soils derived from them as they weather and erode.

The glaciers that have periodically scoured the New England landscape have been the major agents of weathering and erosion. As many as four major glaciation events occurred between 1.6 million and 14,000 years ago—with continent-sized ice sheets spreading south and covering all of New England during periods of extreme cold, then receding north as the climate warmed, leaving behind rocks and fresh soil ready for ants (and other animals and plants) to recolonize (Figure 1.1).

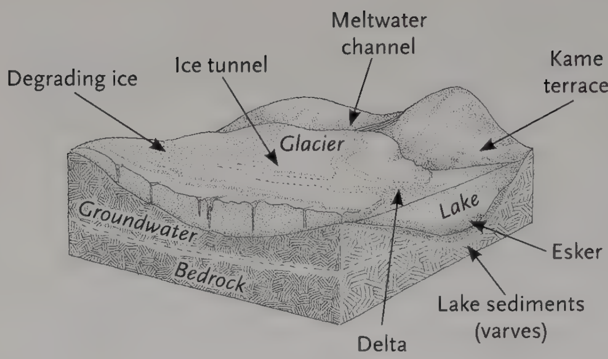


Figure 1.1. A cross section of the land and water formations resulting from glacial development and retreat. Drawing by Elizabeth Farnsworth.

We think of glaciers as pristine, bluish rivers of ice, but in fact they are huge, dirty conveyor belts laden with gravel, sand, and silt. Glaciers move like gigantic bulldozers, reworking and depositing rocks and sediments through a combination of movement and meltwater. Glaciers have left many characteristic signatures, including eskers (sinewy, sandy ridges from the glacier's underbelly visible in central Massachusetts and the Connecticut River valley of New Hampshire and Vermont); drumlins (spoon-shaped hills composed of till overlying knobs of rock, especially common on Cape Ann); kames (terraces of till pushed up against the flanks of hills visible along many valleys in Vermont); kettles (bogs and wet depressions left on the coastal plain by stranded icebergs that melted in place); and sandy outwash plains and deltas (formed as melting glaciers discharged their loads in places such as the Katama Plains of Martha's Vineyard, the Montague Sandplains of Massachusetts, and the dunes and deltas of the Connecticut River valley). Glacial melting and recession (deglaciation) took place in fits and starts. When the leading edge (or toe) of a glacier pushed forward as fast as it was melting, lots of reworking of sediments occurred, even though the glacier appeared to remain stuck in place. Enormous piles of unsorted rock debris, called moraines, were dumped unceremoniously, concentrated, and mounded up at the glacier's toe. Long Island is a terminal moraine formed at the southernmost extent of the glacier; Block Island, Martha's Vineyard, Nantucket, and Buzzards Bay were all formed as the most recent (Wisconsian) glacier paused for a few thousand years as it receded north from the last glacial maximum, 21,000 years ago.

Moraines occasionally created dams, stopping the flow of melting ice and creating temporary glacial lakes, of which Lake Hitchcock in the Connecticut River valley was one of the largest. This lake stretched nearly 650 km from what is now New Britain, Connecticut, to St. Johnsbury, Vermont. When the dam burst about 12,400 years ago, it left behind layers of sediment that had been deposited at the bottom of the lake for thousands

of years. Today, the rich mixture of clays and sands from these former lake bottoms underlies the floodplain of the Connecticut River and is the basis for the most fertile agricultural soils in New England; sweet asparagus, leaf tobacco, and the Labor Day Ant, *Lasius neoniger,* are hallmarks of this soil in the Pioneer Valley of Massachusetts.

When the glaciers at last loosened their icy grip on New England about 12,000 years ago, a period of rapid climatic change (both warming and cooling) ensued, allowing plants—and ants—to recolonize from the unglaciated south. A period of especially dry, warm weather (the so-called Hypsithermal) prevailed between 9,000 and 5,000 years ago; this warming may have been enhanced by small changes in Earth's angle of tilt relative to the sun. During the Hypsithermal, New England supported expansive grasslands reminiscent of today's Midwestern prairies. Remnants of these grasslands still persist in coastal areas of Maine, Massachusetts, Rhode Island, and the islands of Massachusetts, including Martha's Vineyard and Nantucket, that lie to the south of Cape Cod. Ants such as *Formica knighti, F. reflexa,* and *F. ulkei,* which are common in Midwestern prairies, can still be found in New England in these isolated grassland fragments.

Never content to remain stable for long, Earth's climate cooled sharply between 1500 and 1850 A.D. This 350-year Little Ice Age gave New England a reprise of cold summers and often deadly winters. Did ants pack up and move south, or did boreal species such as *Myrmica brevispinosa* and *Formica hewitti* expand their range, only to shrink back to their alpine redoubts when the climate warmed again? Although the biogeographic history of species' range shifts is difficult to trace, the signatures of these great climatic changes are reflected in the composition of the ant fauna we see today (see Chapter 6).

It's All About the Soil

What do continental collisions and titanic ice ages mean to an ant? Most New England ant species are creatures of the soil, and much of New England's soil has been ground (so to speak) out of bedrock by ice and water. Many ants are quite choosy about the soils they inhabit. Some, like *Solenopsis* cf. *texana,* will nest only in the purest fine sands of windy beaches. Add even a minute amount of clay into the mix, and they are replaced by their less finicky cousin, *S. molesta.* And no ground-nesting ant prefers soggy soil; even bog ants (*Myrmica lobifrons*) seek out dry microhabitats, nesting and foraging in the relatively high ground atop hummocks of *Sphagnum* moss.

Stable soils, such as till, consist of well-defined layers or horizons topped by a shallow organic surface composed of decaying plant litter. Just below the litter layer is the A horizon, where organic material is constantly being

mixed with mineral soil by soil dwellers like ants and earthworms. Farmers also deepen this layer with their plows; even in soils that have been fallow or reverted to forests long ago, this plow layer (usually about 0.5 m deep) is still visible today. Iron, clay, aluminum, and other minerals leach from the A horizon and accumulate in the underlying mineral soil (the B horizon). Beneath these zones, in the C horizon, new soil is created through the erosion of underlying bedrock.

For an ant colony to survive the cold New England winters, most ground-dwelling ants need to dig nests that reach well below the frost line: at least 1 m deep, extending well into the B or C horizon. As we discuss in Chapter 2, ants performing the simple routines of nest housecleaning also have profound effects on the chemistry, aeration, and recycling of mineral soils brought up from the B horizon. Because ground-dwelling ants must excavate soil to build and maintain their nests, many species are very sensitive to soil texture, which is defined by the relative proportions of sand, silt, and clay. It is less clear whether ants also are sensitive to soil chemistry. For example, are some species more commonly associated with high-pH, basic soils derived from limestone, or are they more commonly associated with lower-pH, acidic soils derived from granite? More observations and experimental research are sorely needed in this area.

However, not all ants nest in pure soil. The familiar Eastern Carpenter Ant, *Camponotus pennsylvanicus,* carves its nests in decaying wood (mostly in dead limbs or hollow trunks of living trees, fallen logs, and yes, sometimes in wet or rotting wood in houses). Other species, such as *Temnothorax longispinosus,* nest in dead, hollow twigs. Still others, such as *C. caryae* and *T. schaumi,* nest under bark high in tree canopies. Many species of *Lasius,* especially the citronella ants in the *claviger* group, seek the shelter of rocks, digging out nests beneath them (and scurrying willy-nilly when you happen to pick up that rock). Still others, including *T. ambiguus* and the species that enslave it, such as *Protomognathus americanus,* nest in tiny acorns! Finally, some "tramp" species (tiny, mostly tropical, ants that breed rapidly and disperse over long distances), including the Crazy Ant (*Paratrechina longicornis*) and the Pharaoh Ant (*Monomorium pharaonis*), colonize basements, kitchens, and other nooks of human habitation—the only New England habitats reliably warm enough to shelter them year-round.

But Vegetation Matters, Too

Both soils and climate heavily influence the composition of vegetation in different regions of New England. New England's climate varies considerably from the coast (with its maritime influences) to inland (with its continental influences). Cold coastal waters are slow to warm up in the spring and keep air temperatures cooler on Cape Cod than in the interior well into

the early summer. Likewise, the mountains of our region experience much cooler temperatures throughout the year than do lower-elevation sites, shaping the plant communities that occur from north to south and from summit to valley. Because temperature and vegetation go hand in hand, ecologists classify New England broadly into five ecoregions—areas that share similar climates, growing seasons, and plant community types (Figure 1.2). If you travel along a transect from northern Maine to southwestern Connecticut, collecting ants along the way, you will find very different suites of species inhabiting these ecoregions. We discuss general patterns here and look at potential causes of these patterns more closely in Chapter 6.

Northern and western Maine, most of New Hampshire and Vermont, the Berkshire Mountains and Worcester Plateau of Massachusetts, and the Litchfield Hills of Connecticut are in the Northeastern Highlands ecoregion. This ecoregion is cloaked in boreal forests dominated by hardy spruces, firs, white pines, and northern hardwoods including oaks, American Beech, and Sugar Maple. Bogs reminiscent of Alaskan tundra are the predominant wetlands in this ecoregion. Our highest peaks—Mount Katahdin in Maine, Mount Mansfield and Camel's Hump in Vermont, Mount Washington and the other high peaks of the Presidential Range in New Hampshire,

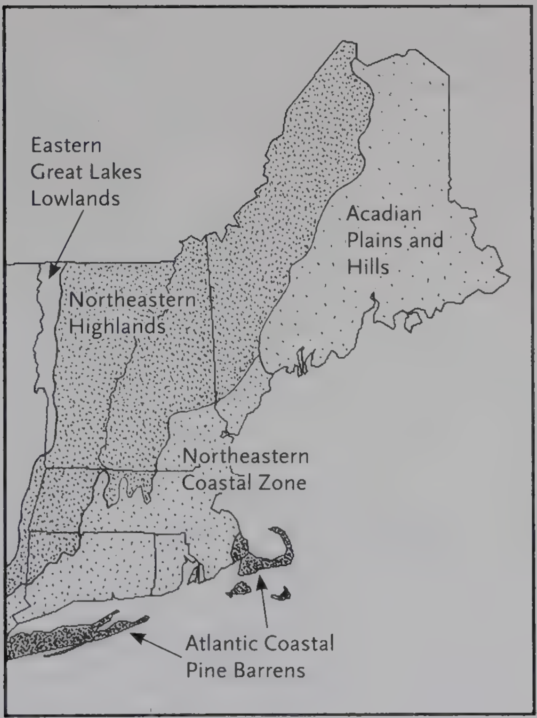


Figure 1.2. The five ecoregions of New England. Drawing by Elizabeth Farnsworth.

and Mount Greylock in Massachusetts—have low-lying alpine vegetation that has clung to these summits since the glaciers receded. Boreal and cold-climate ant species such as *Camponotus herculeanus, Formica hewitti, F. podzolica,* and *Myrmica brevispinosa* extend their ranges into New England only in the Northeastern Highlands.

Down East Maine (the low-elevation regions of central and northeastern Maine), with its rolling plains, low hills, many lakes and ponds, and a rocky coastline, forms the Acadian Plains and Hills ecoregion. This ecoregion is characterized by a mixture of northern deciduous hardwoods (predominantly Red Oak, Sugar Maple, and American Beech) and evergreen conifers (spruces, firs, Eastern Larch, and Northern White Cedar). Productive farms, pastures, and blueberry barrens punctuate the forest and are home to prairie ant species such as *Formica ulkei* and *F. knighti*. Down East Maine's unique coastal raised bogs perch atop granite bedrock and host bog specialists and cold-climate ant species, including *Dolichoderus mariae, Formica neorufibarbis, Myrmica alaskensis,* and *M. lobifrons*.

The Northeastern Coastal Zone ecoregion consists of the southern part of coastal Maine, coastal New Hampshire, all of Rhode Island except Block Island, and the portions of Connecticut and Massachusetts (excluding Cape Cod and its offshore islands) that are lower in elevation than 300 m above sea level. The temperate and diverse mix of vegetation in this ecoregion consists of deciduous forests, grasslands, and sedge meadows that extend south from New England into the Mid-Atlantic coastal plain and piedmont. Southern woodland ant species, such as *Camponotus americanus, C. castaneus, C. chromaiodes,* and *Formica creightoni*, are characteristic of this ecoregion.

Cape Cod, Martha's Vineyard, Nantucket, and Block Island, together with New York's Long Island, are in the Atlantic Coastal Pine Barrens. This unique ecoregion is dominated by Pitch Pine, Black Oak, Chestnut Oak, and blueberries growing on sandy soils. The once extensive pine barrens have been modified heavily by human activities, and only small remnants of true pine barrens—a globally threatened ecosystem—remain in New England. Many southern species of ants, notably *Pheidole pilifera, Monomorium viride, Solenopsis* cf. *texana,* and *Temnothorax texanus* are found in this ecoregion.

Finally, the Lake Champlain valley at the northwestern edge of Vermont is part of the Eastern Great Lakes Lowlands ecoregion. Before European settlement, the forests here were dominated by hardwood trees more characteristic of Mid-Atlantic latitudes, including Beech, White Oak, ashes, and hickories. The rich soils of the Champlain valley encouraged farming, and now most of this ecoregion is devoted to agriculture and residential development. Nevertheless, some southern ant species, such as *Camponotus*

chromaiodes, find the comparatively warm (for New England) climate around Burlington most hospitable.

Small-scale differences in vegetation within ecoregions profoundly influence microclimate, and ants respond accordingly. Having tiny bodies with large surface-area-to-volume ratios, ants are very sensitive to temperature and thus to the plant communities around them. Warmer south-facing slopes of hills will support different ant species (and vegetation) from cooler, north-facing slopes. Deciduous hardwoods and evergreen conifers reflect the sun's rays differently, thereby influencing the temperature on the ground; in winter or summer you have only to walk from a clearing to the deep shade of a conifer forest to appreciate the difference in temperature. On a balmy spring day when the temperature reaches 15° C—the minimum average yearly temperature at which most ant nests really wake up—you will find an abundance of species in oak glades. Just a few meters away, under a dense canopy of hemlock trees, only one or two cold-tolerant species, such as *Aphaenogaster picea,* will be out and about.

Of course, land cover is not static over time, and therefore neither is the ant fauna. What happens if you clear-cut that dense hemlock stand? Suddenly warm sun floods the forest floor, which is now covered with twigs, branches, and other coarse woody debris. Different species of ants, especially *Formica* species, quickly colonize these newly logged patches in the forest. Three years later, a thick tangle of raspberries and impassable stands of young birches will have taken hold. These may discourage humans from passing through, but other species thrive in these dynamic habitats. Twenty years on, as the free-for-all scramble among the plants has begun to calm down, a more stable mixture of pines and maples will have overtopped the fly-by-night birches; look for *Camponotus novaeboracensis* nesting in fallen birch logs and under bark. Hemlocks and shade-tolerant oaks lurk in the understory, waiting for one of those pines to fall and open up a light gap in which they can grow. In a hundred years or more, a tall forest of mixed conifers and hardwoods will have grown up; look among the acorns for tiny *Temnothorax curvispinosus* nests, in the leaf litter for small nests of the handsome *Stenamma impar,* and in standing dead tree trunks for larger nests of *C. nearcticus*. And a few ant species, such as *Lasius speculiventris,* nest mostly in the moist soils of the oldest forests, especially those that were never logged.

In many ways, this type of ecological succession mirrors the historical pattern of land cover change in New England over the past three centuries. Arriving in the 1600s, early European colonists documented vast stands of old-growth coniferous and mixed-deciduous forests interspersed with clearings and occasional burns made by Native American hunters and farmers. Following settlement, nearly 80% of New England's forests, especially

in the Connecticut River valley and the Champlain basin, was cleared in the 1700s to make way for crops, pastures, and cities (Figure 1.3).

In the wake of the Industrial Revolution, subsistence farming largely disappeared from New England, and by the early 1900s abandoned farmlands slowly began to revert to forest. This succession proceeded from field to old field to forest, and today the majority of the New England landscape is forested once again (Figure 1.4).

New England's agricultural history remains visible in the ubiquitous stone walls built by European colonists and their oxen (Figure 1.5). These stone walls are also good places to look for ants; *Stigmatomma pallipes,* for example, often forages between the rocks. Unfortunately, suburban developments and urban sprawl are making inroads into forests, and some elements of mature forests, including many understory orchids and other herbaceous plants, may never fully recover. Although the seeds of many spring woodland flowers are dispersed by ants, especially by *Aphaenogaster picea* and *Myrmica punctiventris,* the seedlings are rapidly eaten by burgeoning populations of deer, which are no longer held in check because their native predators (mountain lions or catamounts, wolves, and lynxes) are now extinct or very rare.

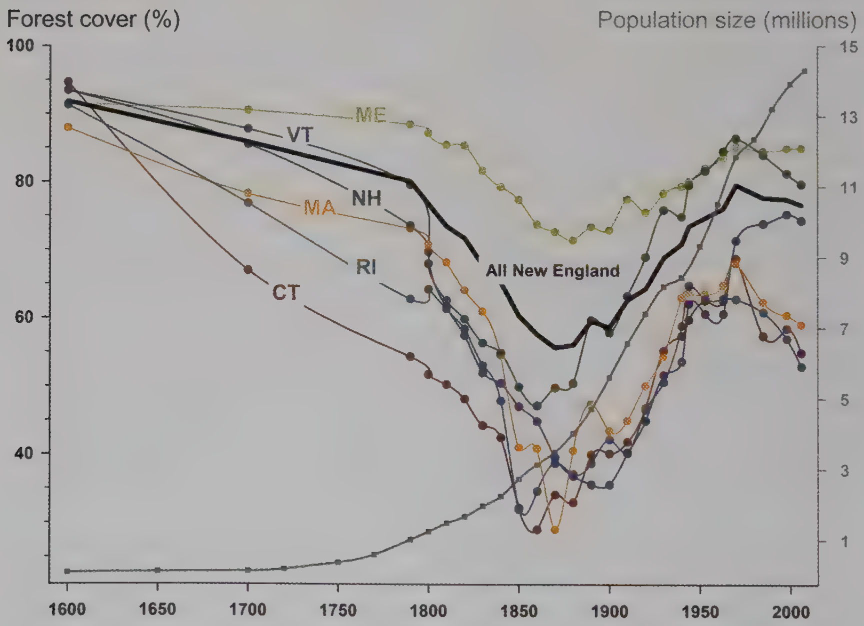


Figure 1.3. The forest cover of each of the six New England states (as a percent of total state area) and of all of New England (as a percent of total area) since European settlement, along with total New England population size since 1600. Data courtesy of Brian Hall and David Foster, Harvard Forest.

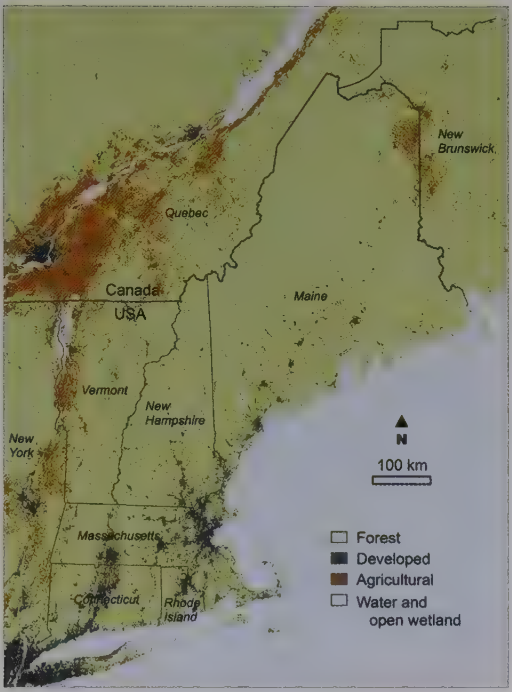


Figure 1.4. The current land cover of New England and adjacent counties of New York and provinces of Canada, based on 2001–2007 data from NASA's Moderate Resolution Imaging Spectroradiometer (MODIS) (http://modis.gsfc.nasa.gov/). Map produced by Brian Hall, Harvard Forest.

Figure 1.5. The stone walls meandering through New England's forests are good places to look for ants.

Glaciers flowed and receded; New England was colonized, cleared, and in places abandoned; but the forests, pine barrens, grasslands, and wetlands have remained. Their persistence and recovery demonstrate the resilience of New England ecosystems. We will never know all the details of how ants responded to these major historical changes, but we can learn much about these insects, their ecological interactions, and their influences on ecosystems by studying them in the multitude of different habitats in our region.

2.
Ant Basics: Evolution, Ecology, and Behavior

The Life of Ants

Ants are very different from most other animals. They form large colonies of closely related individuals, many of whom have specific tasks required to maintain the colony, and most of whom are unable to reproduce themselves. The ant you see crawling up a tree trunk or along your kitchen counter is almost always a sterile female. She will never reproduce, and she works exclusively for the benefit of the queen and the rest of her colony. An active ant colony consists of one or several queens—the only females that reproduce—and anywhere from a couple of dozen to tens of thousands of female workers. These workers carry out all the activities of the colony other than reproduction. They gather food, care for the young, defend the colony from predators and invaders, maintain the chambers and passageways, remove waste and debris, and even (in some specialized species such as *Prenolepis imparis*) store food. Queens (and their colonies) can live for decades, but workers rarely live longer than a single year or growing season. Males are produced only when the colony is about to undergo sexual reproduction, but they contribute nothing to the care and maintenance of the colony.

How does an ant colony get started? In response to a variety of cues, including day length, temperature, crowding, or stress, the queen lays eggs that develop into special winged (alate) females (virgin queens) or winged males. After rains and during daylight hours, especially early mornings or late afternoons, the virgin queens and males fly out of the nest to mate, after which the males die and the now inseminated queens go on to form new colonies. These nuptial flights can be spectacular, especially in the boreal forests of New England, where huge clouds of winged ants in the genus *Lasius* rise into the air from many different nests (Figure 2.1).

Ant swarms often alarm homeowners because they resemble swarming termites, but a closer look reveals clear differences between termites and ants. Our common termites are small, soft, white, and fat (Figure 2.2). Even though they may be called "white ants," they are more closely related to cockroaches than they are to any insect species in the order Hymenoptera, which includes the ants, along with the bees and wasps. Three important characters (among many others) distinguish Hymenoptera (including the ants) from termites: the front wings of Hymenoptera (present only on alate queen and male ants) are larger than their rear wings, but they are the same size in termites; most Hymenoptera, including the ants, have a "wasp waist" (a narrow constriction in their body; see Chapter 4 for more details), whereas

Figure 2.1. A mating swarm of *Lasius umbratus* emerges from a large hollow oak tree on the flanks of Mount Monadnock in southern New Hampshire.

Figure 2.2. The Eastern Subterranean Termite (*Reticulitermes flavipes*) is more closely related to cockroaches than to ants, bees, or wasps. Unlike ants, termites have bead-like antennae and lack a pedicel, the narrowly constricted "wasp waist" in the middle of ants' or wasps' bodies. These termites were nesting under a rock near a colony of *Lasius flavus* at the High Ridge Wildlife Management Area in central Massachusetts.

termites do not; and the distal ends of the legs (the tarsi; see Chapter 4) of Hymenoptera have five segments, whereas those of termites have only four.

In some ant species, such as *Aphaenogaster rudis,* the alate females will mate with only a single male. In others, such as the European Fire Ant, *Myrmica rubra,* a single female may mate with five or more males. But whether there are single or multiple matings, this is the only point in the life cycle of a colony (Figure 2.3) at which mating occurs. The queen will spend the rest of her life inside her colony, and all her fertilized eggs will be produced with sperm that has been stored from this single mating flight.

The males die immediately after they mate with a queen, but the newly-mated queen lands, sheds her wings, and searches for a patch of soft soil, a hollow twig, an acorn, a rotting log, or a protected place beneath a small stone roof where she can found a new colony. Most queens never make it; the vast majority land on inhospitable terrain and end up as food for birds, other insects, or even the occasional carnivorous plant (Figure 2.4). The lucky females who land in a good spot dig in and quickly lay a first batch of fertilized eggs, converting some of their wing muscle tissue into spitlike salivary secretions to feed their new brood. The female workers that hatch

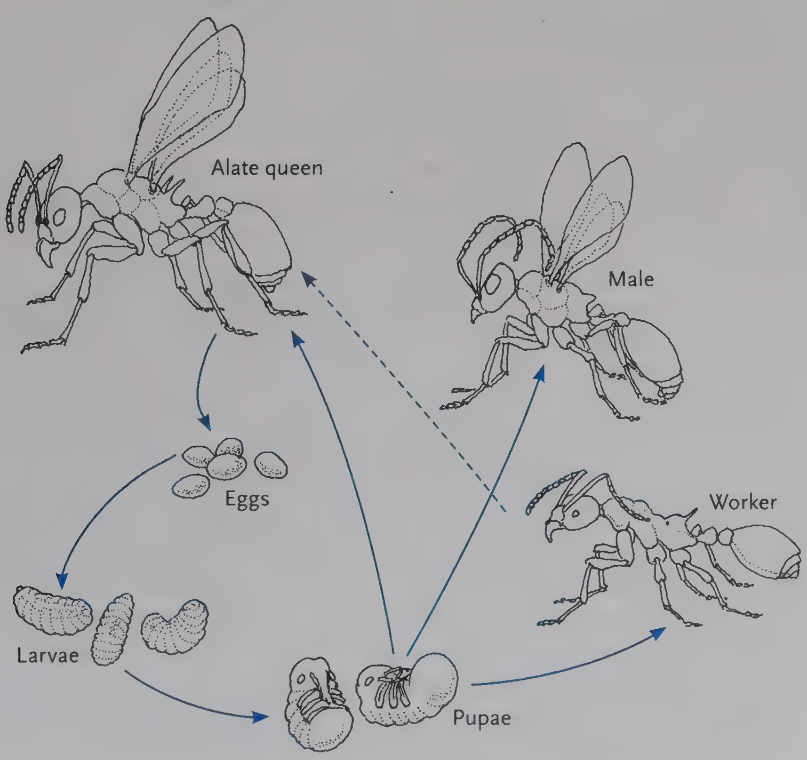


Figure 2.3. The life cycle of an ant colony. Drawings by Elizabeth Farnsworth.

Figure 2.4. A queen New York Carpenter Ant, *Camponotus novaeboracensis*, mistakes an insectivorous pitcher plant for a safe nest site.

from these founding eggs will begin gathering food, enlarging the nest, and tending the queen, helping her to produce more sisters for the colony. This first cohort of workers, called nantic workers, are much smaller than the workers that are produced later in the life of the colony.

The colony now begins an extended growth phase that can last anywhere from several months to several years, depending on the species and the life span of the queen. During this growth phase, the queen continues to produce broods of eggs that will hatch into more sterile (female) workers. In most species, workers take on different tasks as they age. Young workers attend the queen and take care of eggs and pupae. Older workers feed and care for the maturing larvae. The oldest workers forage for prey, maintain and expand the nest, and defend it from predators, competitors, and slave-raiders.

In many genera, the tasks that any individual worker performs change from day to day, depending on the needs of the colony and interactions among the workers. But in a handful of genera, including *Camponotus* and *Pheidole* here in New England, eggs develop directly into different castes of workers with distinct sizes and appearances that fulfill specialized roles in the life of the colony. The smaller, "minor" workers do most of the colony maintenance and foraging, whereas the largest, "major" workers defend the nest and stores of food. The number and types of workers produced by the queen are under delicate chemical and hormonal control, which is mediated by the quantity and quality of food that is brought back to the nest and by the relative numbers of individuals in different castes.

Whether colonies have flexible workers or fixed castes, without the guiding chemical control of the queen, the activity and behavior of the workers can become disorganized or random. If the queen dies or is removed from the nest, the entire colony usually disintegrates and dies. In a few species,

however, workers will begin to produce eggs if the queen dies. Because these eggs are unfertilized, they usually develop into males (see the discussion of haplodiploidy and the evolution of eusociality later in this chapter). In rare cases, however, workers can produce new queens either from unfertilized eggs (parthenogenetically) or after mating with a male ant.

An ant colony will continue to grow in size and add workers, but at some point it becomes mature and will begin sexual reproduction by producing virgin queens and males. Many species produce males and reproductive females just before the nuptial flight. Others produce males and reproductive females that stay in the nest for a long time before the nuptial flight. Our largest carpenter ant, *Camponotus herculeanus*, produces males and virgin queens in late summer. They are groomed and fed by workers throughout the fall and winter before they emerge from the colonies for their mating flights in the spring. Finally, some species, including *Monomorium pharaonis* and *Myrmica rubra*, have large colonies with multiple queens that create new colonies asexually by fragmenting the original colony. However, even these polygynous (literally, many queens) and polydomous (literally, many houses, referring to their many nests) ants eventually go through a phase of sexual reproduction in which males and new queens are produced.

The ant colony thus functions as a highly social, organized "superorganism." The queens and most workers are safely hidden below ground or protected within the interstices of rotting wood. But for the ant workers that must go out and forage for food for the colony, life above ground is short and dangerous. The single ant that you see running across the forest floor or your kitchen counter is, in reality, a short-lived, specialized extension of the colony itself, just as an individual leaf is a specialized part of a single living tree.

What Makes an Ant an Ant?

Ants are insects, and insects are arthropods: invertebrates (animals without backbones) within the larger group of animals that includes lobsters, spiders, and lice (Box 2.1). Like all insects, ants have a segmented body consisting of three major regions (head, thorax, and abdomen), compound eyes and antennae on the head, three pairs of jointed legs on the thorax, and an external (outer) skeleton made of chitin (a stiff, starchy compound that feels like fingernails) covering the entire body. Ants are all members of one insect order: the Hymenoptera. This order also includes the sawflies, bees, and wasps. With nearly 150,000 described species, the order Hymenoptera contains more species than any other order of insects except for the beetles (Coleoptera) and the butterflies and moths (Lepidoptera). All Hymenoptera have membranous wings, an egg-laying organ (called an ovipositor) that is frequently modified into a stinger, chewing mouthparts

Box 2.1. Ants in the animal kingdom

Biologists classify organisms in a hierarchy of groups, beginning with their kingdom. Ants are in their own family—a relatively fine division within the animal kingdom.

Kingdom: Animalia—multicellular organisms that have to eat other organisms to survive.

Phylum: Arthropoda—animals without backbones that have an exoskeleton, a segmented body, and jointed appendages (legs, antennae).

Class: Insecta—arthropods with an exoskeleton made of chitin, a body with three major parts (head, thorax, and abdomen), three pairs of jointed legs, compound eyes with multiple reflecting lenses, and two antennae.

Order: Hymenoptera—the ants, bees, wasps, and sawflies.

Family: Formicidae—the ants.

(although the proboscis of bees has been modified for drinking nectar), complete developmental metamorphosis with larval and pupal stages (so-called holometabolous development), segmented antennae, compound eyes, and a narrow "waist" (except for the most ancestral group, the sawflies).

Within the Hymenoptera, the ants are in their own family: the Formicidae. Ants are distinguished from the rest of the Hymenoptera by two key evolutionary innovations: (1) a distinctive metapleural gland that secretes antibiotics that keep the ant exoskeleton free from bacteria and fungal spores that could infect the nest and (2) a morphological modification of the typical hymenopteran narrow waist into a nodelike structure called the pedicel. Although the pedicel appears to separate the thorax from the abdomen, don't be fooled; the pedicel actually consists of the second segment or the fused second and third segments of the abdomen! This evolutionary rearrangement has led myrmecologists to develop specific terms to describe ant anatomy. Some of these terms are different from those used to describe the "typical" insect (see Chapter 4).

The Evolution of Ants

The insect order Hymenoptera originated in the Triassic period (~250 million years ago), and the oldest fossils of antlike creatures look a lot like wasps. In fact, a short-lived side branch of the hymenopteran evolutionary tree had

characteristics of both ants and wasps. These insects, which went extinct 45–65 million years ago, are called sphecomyrmines (from the Greek *sphéx,* meaning wasp, + *myrmex,* meaning ant).

The modern ant appears to have evolved between 115 and 135 million years ago; the earliest definitive ant fossil was found in French amber that is about 100 million years old. Ants first evolved in tropical rainforests, but they diversified rapidly and colonized deserts, grasslands, wetlands, and cold northern and high-elevation habitats. Today they occur in all terrestrial habitats on every continent except Antarctica. Even Arctic regions and remote islands that originally had no ant fauna now harbor a few introduced species. In New England, the vestiges of all this evolutionary history are evident in the taxonomic distribution of ant species, genera, and subfamilies (see also Chapter 6). The New England fauna includes species from the "big three" subfamilies of ants—the Myrmicinae, Dolichoderinae, and Formicinae—along with a handful of species in three other subfamilies, the Amblyoponinae, Proceratiinae, and Ponerinae (Figure 2.5).

Ants have been in what is now New England for millions of years, leaving when the glaciers covered the land and returning as the glaciers

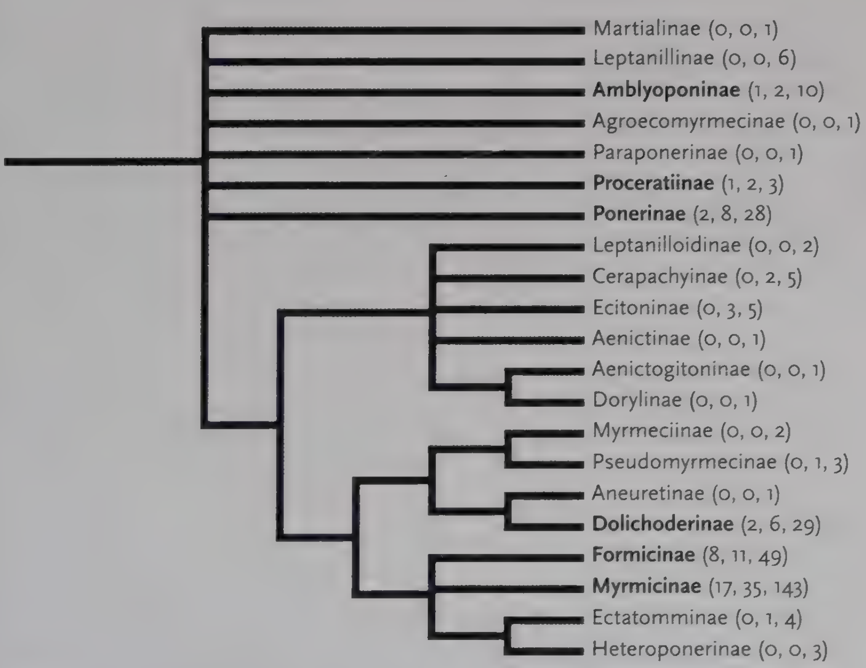


Figure 2.5. The subfamilies of the ants and their evolutionary relationships. Families in **boldface** type include species that nest in New England. The numbers in parentheses after each subfamily are the number of genera in New England, North America, and the entire world, respectively.

melted. Most of the ant species that we find in New England today recolonized our region after the glaciers receded about 10,000 years ago, but others may have evolved and diversified right here. Exotic tropical species, such as army ants and leaf-cutter ants, cannot survive a killing frost or a New England winter. However, some tropical and subtropical tramp species take advantage of global commerce and show up occasionally in New England's hospitals, grocery stores, greenhouses, and warm basements.

Eusociality—The Pinnacle of Social Evolution

Scientists distinguish ants from other insects by their unique morphology. But probably the most important event for ants in their nearly 150-million-year history was the evolution of their complex social behavior. Along with humans, other mammals, and some colonial invertebrates, ants (and the other social insects) represent one of the pinnacles of social evolution. Ants are "eusocial" (truly social); there is a reproductive division of labor, with one (or only a few) reproductive female, a nonreproductive caste of workers, overlapping generations, and cooperative care of young.

Eusociality has evolved repeatedly within the order Hymenoptera. Bees and wasps have several eusocial lineages, but there are also bees and wasps that are solitary or have only a modest degree of social organization. Across the rest of the animal kingdom, eusociality has evolved only in the termites and the naked mole rats, although there is evidence for some elements of eusocial structure in a few species of thrips, gall-making insects, and snapping shrimp. Eusociality is an evolutionary paradox, because classical theories of natural selection (and modern economics) predict that individuals should act in their own selfish reproductive interest. It is hard to understand how evolution would favor the development of sterile castes of workers in which individuals sacrifice their own reproductive potential, caring for the colony and the offspring of the queen instead of reproducing themselves.

The first key to understanding the evolution of eusociality is the observation that all Hymenoptera have a unique genetic system that determines the sex of their offspring. In most animals, males and females are diploid; they each have two sets of chromosomes. One (haploid) set is contributed by each parent in the sperm or the egg. These two haploid sets combine during fertilization so that the offspring is diploid like its parents. But the Hymenoptera are different. Like most other organisms, including humans, all female ants (workers and queens) develop from fertilized eggs produced by uniting an egg and a sperm cell—they are diploid. But male ants develop from *unfertilized* eggs and therefore have only one set of chromosomes—they are haploid. As we described earlier in this chapter, the life cycle of an ant colony consists of repeated production of diploid workers and only

occasional production of diploid queens and haploid males. We refer to this as a haplodiploid sex determination, or haplodiploidy for short.

An important consequence of haplodiploidy is that females share more genes with their sisters than they do with their own daughters. The theory of kin selection predicts that eusociality should evolve in haplodiploid organisms. Workers that give up their own reproduction to help the queen produce more sisters are actually behaving selfishly (in an evolutionary sense), because more copies of their genes will spread through their sisters (kin) than through their own production of daughters. This is the concept of inclusive fitness: if you are not going to produce your own offspring, take care of your siblings (and other more distant relatives) with whom you share genes. In contrast, the haploid males are not more closely related to their sisters than to their own offspring. The theory of kin selection correctly predicts that males of eusocial species should spend all their time selfishly reproducing (or trying to reproduce) rather than working to contribute to the success of their sisters' colony.

However, haplodiploidy cannot be the ultimate explanation for the evolution of eusociality. Although all ants are eusocial, many groups of bees and wasps are not, even though they all have haplodiploid sex determination. Eusociality also has evolved in some animal species that have typical diploid males, such as naked mole rats and termites. An alternative hypothesis for the evolution of eusociality is that one female (the queen) can dramatically increase her fitness if she can prevent her offspring from reproducing and instead force them into caring for all her young. Other characteristics of Hymenoptera that may have favored the evolution of eusociality in this order of insects include the habit of group nest-building (which favors cooperative defense) and the repeated occurrence of trophallaxis—the regurgitation of liquid fed to other members of the colony during cooperative care of offspring. But whatever the ultimate forces leading to the evolution of eusociality, it is certainly responsible for much of the evolutionary and ecological success of the ants. The modest ant worker running across the pavement reflects millions of years of successful morphological evolution and social organization that have led to the ecological dominance of ants throughout the world.

Ant Ecology

Ants are the unseen and unrecognized giants of the terrestrial world. Most ant species are small, usually less than 10 mm long, although the largest living ant, Wilverth's Driver Ant (*Dorylus wilverthi*), is a whopping 52 mm long. The largest ant that ever lived is the extinct Lube's Titanic Ant, *Titanomyrma lubei,* whose ~57-mm-long queens roamed the hills of Wyoming

nearly 50 million years ago. But despite their small individual size, ants en masse outweigh all other invertebrate groups and may comprise as much as one-third of the mass of all insects on Planet Earth. In one study in a Brazilian rainforest, the total mass of the ants was approximately four times greater than that of all mammals, reptiles, and amphibians combined!

Although ants are everywhere, they are not especially conspicuous because most ant colonies are underground; we see only the actively foraging workers on the surface or the occasional mating swarm. But it is the ants, not the earthworms, that are the prime movers and turners of soil. The classic brown (podzolic) soils of northern New England are created by ants continually digging up soil from deep beneath the surface, leading to a layer of 25–45 centimeters of brown topsoil that accumulated over several thousand years before European colonists began to plow it for agriculture. Indeed, because ants are so abundant and widespread, it is difficult to imagine what Earth's vegetation and soils would look like without them.

Ants are the chief scavengers and garbage collectors of the forest, efficiently consuming and disposing of animal carcasses. Several species of ants that lurk in the dry and decaying leaves littering the forest floor are specialist predators that consume springtails, mites, spiders, and other microfauna. Ants themselves are prey for birds, small mammals, spiders, and other insects.

Ants also compete with one another for limited ecological resources, especially food and nesting sites. Competition among ants occurs directly, when ants engage in coordinated territorial combat and defense of food resources, as well as indirectly, when many species jointly exploit scarce resources. Ants move plants around, too. In New England, the common forest ant *Aphaenogaster rudis* collects the seeds of many different understory herbs, including Wake-robin (*Trillium*), Bloodroot (*Sanguinaria canadensis*), Wild Ginger (*Asarum canadense*), Fringed Polygala (*Polygala paucifolia*), violets (*Viola*), and some species of sedges (*Carex*). Attached to the seeds of these herbs is a fleshy, fat-filled structure called an elaiosome, which is an attractive food for many ants. The ants collect the seeds, eat the elaiosomes, and leave the seeds in or near the nest, where they can germinate in the nutrient-rich soil that the ants have turned over. In many of our forests, *Aphaenogaster rudis* and *A. picea* are the most common and abundant ants to be found, and the more *Aphaenogaster* nests that are present in the forest, the higher the density of understory herbs.

Other ants, including the widespread silvery-colored *Formica subsericea,* tend aphids and scale insects that themselves are feeding on plant juices. As the aphids and scale insects pump fluids from the plant into their bodies, the ants harvest the sugar-rich liquid they excrete. This honeydew can be either a sweet treat or the primary food supply for the ant colony. Other ants

are predators: New England's three *Proceratium* species prey only on spider eggs, and our *Pyramica* species stalk centipedes.

Social Parasitism—Guests, Inquilines, Temporary Parasites, and Slave-Makers

Parasites have evolved to exploit almost every kind of organism. The primary characteristic of a parasite is that it is physically dependent on another species (the host) for at least part of its life cycle; the parasite cannot survive and reproduce successfully without the host. For example, parasitic plants attach to roots or other parts of other plants and suck nutrients and carbon from the host. Without this source of essential nutrients and energy, the parasite dies. Parasitic roundworms take up residence inside humans, feeding on blood, tissue, or your last meal. Without the food and shelter provided by your body, these roundworms could not survive. Parasitic protozoa, including the species that cause malaria in humans and birds, have evolved complex life cycles that require multiple species of hosts to house them, feed them, and move them around.

Many kinds of parasitism have evolved among the ants, too. Myrmecologists recognize four different kinds of social parasites (the term *social* refers to the fact that these parasites have evolved in the eusocial insects): guest ants (also called xenobiotics), temporary social parasites, slave-makers (also called permanent social parasites with slavery, dulosis, or pirates), and inquiline social parasites (also called permanent social parasites without slavery). Among the ants, fewer than 2% of species are known to be parasites, but continued exploration and study of ant natural history, especially in the tropics, regularly uncover new parasitic species. And a surprising number of temperate-zone species in the ant subfamilies Myrmicinae and Formicinae are parasitic. In New England alone, we have at least 42 species of social parasites—over one-third of our resident species!

Guest ants are fed by, and live in the same nest as, their host. Unlike the other three kinds of social parasites, guest ants rear all of their own workers. In New England, we know of only one such guest ant: *Formicoxenus provancheri* is a guest of *Myrmica incompleta. Formicoxenus* forms small nest chambers within the nest of *M. incompleta,* and the hosts regurgitate food into the mouths of the guests. This behavior co-opts some of the energy from the host colony but does not compromise its existence.

Temporary social parasites depend on their hosts only to found a new colony. After she has mated, the founding parasitic queen enters a host colony and kills or otherwise removes the host queen. As the parasitic queen lays her own eggs, the host workers care for them, rearing her brood as if they were the hosts' sisters. As the host workers age and die, they are

replaced by the parasite workers; eventually the colony is made up entirely of the parasite queen and her offspring. In New England, many species of *Lasius* and *Formica* are temporary social parasites.

Slave-makers, on the other hand, depend on one or more host colonies for their entire lives. As with temporary social parasites, the first step in enslaving a colony is for the founding parasitic queen to find a host colony and kill or expel the host queen. In some species, including our own *Harpagoxenus canadensis,* the parasitic queen kills or otherwise removes all the host workers, too. In other species, the host workers start to care for the parasitic queen and her offspring. But in both cases, the offpring of the parasitic queen do not care for their brood or forage for their own food. Rather, the parasite workers raid other colonies of the host species and carry off the captured brood. Once these captives are returned to the parasite's nest, they do all the work required to keep the colony clean and well fed. In New England, species in the *Formica sanguinea* group, our two *Polyergus* species, and *Protomognathus americanus* are the most common slave-making ants.

Finally, inquiline social parasites have dispensed with workers altogether. A founding parasitic queen invades the host's nest but usually does not kill the host queen. Instead, the host queen continues to produce her own workers, who care for the parasites' offspring, which are only males and new queens. In rare cases, the parasite queen can only invade a nest in which the host queen has died; this appears to be the case in New England for *Anergates atratulus,* which is an inquiline social parasite of the Pavement Ant, *Tetramorium caespitum.* Other New England inquiline social parasites are in the genera *Leptothorax, Myrmica, Nylanderia,* and *Tapinoma.*

A key feature uniting all these forms of social parasitism is that the parasite queen co-opts the host's workforce, either by displacing the host queen (temporary social parasites and slave-makers) or by exploiting the workers that the host queen continues to produce (guests and inquilines). How does the parasite queen manage to convince the host colony to care for her (and her offspring)? Ants belonging to a single colony recognize each other by the unique chemical signature of the nest; essentially, they use their antennae to taste and smell each other. If other ants smell right, they're sisters, but if not, they're foreign and must be removed or killed. Parasitic species have to mask their own smell and quickly take on the chemical signature of the host colony, and they do this in a variety of ways. For example, on her way into the host's nest, the parasitic queen might grab a host worker, kill it, chew it up, and smear herself with the unique chemicals from the cadaver's exoskeleton. Alternatively, the parasitic queen does the same thing to the host queen once the parasite enters the brood chamber. Slave-makers that capture foreign broods transfer their own chemical scent to the slave workers as they hatch. There are many variations on these

themes, but virtually all of them involve the use of distinctive hydrocarbons —molecules made up only of carbon and hydrogen—that are found on the surface of ants' exoskeletons.

Myrmecophily—Life among the Ants

Socially parasitic ants are not the only species that invade, co-opt, or otherwise take advantage of ants and their nests. Myrmecophiles—literally, ant lovers (from the Greek *myrmex,* meaning ant, + *philos,* meaning loving)—can be found in all corners of the animal kingdom. Mites, flies, beetles, butterflies, crickets, and many other organisms spend part or all of their lives in the warm, dry, and secure nests that ants build. Like the social parasites, the myrmecophiles use chemical deception to insinuate themselves into their hosts' nests.

Myrmecophiles range from parasites that feed on their hosts to mutualists that enhance the survivorship or reproduction of the host colony. In New England, the most common myrmecophiles are scarab beetles in the genus *Cremastocheilus,* clown beetles in the genus *Haeterius,* rove beetles in the genus *Xenodusa,* and hoverflies in the genus *Microdon.* We also have our share of myrmecophilous crickets, in the aptly named genus *Myrmecophilus* (Figure 2.6).

Cremastocheilus beetles live in nests of various species of *Formica,* where the adult beetles feed directly on the larvae or brood of the ants. The beetle grubs (larvae) feed on the accumulated detritus of the nest. Adult *Hetaerius* beetles steal liquid food from ants as they exchange food with each other. A few species of *Hetaerius* also have been observed actively soliciting food from ant workers; the ant responds by regurgitating bits of food into the mouth of the beetle. The immature stages of *Hetaerius* beetles have yet to be found. If the ants ever attack either of these beetles, the victim will play dead—staying perfectly still and holding its legs tight to its body. The ants may then carry the beetle around and taste or smell it with their antennae, but they eventually release it, whereupon it resumes foraging in another chamber of the nest.

Xenodosa beetles have a very interesting life cycle. The larvae spend the summer in nests of *Formica* species, including *F. exsectoides* and *F. incerta.* The beetle larvae are cared for and fed by the host ants; occasionally the larvae will eat some of the host workers. In midsummer, the larvae leave the *Formica* nests and move into nests of carpenter ants, including *Camponotus americanus, C. chromaiodes, C. novaeboracensis,* and *C. pennsylvanicus.* There they overwinter, completing their larval development, pupating, and eventually emerging as adults.

Hoverflies in the genus *Microdon* have a similarly bizarre life history. The fly lays its eggs on the surface of the host ant's nest. As soon as the

Figure 2.6. The most common of New England's myrmecophiles include (clockwise from top left): larvae of the syrphid fly *Microdon ocellaris*, the scarabid beetle *Cremastocheilus variolosus*, crickets in the genus *Myrmecophila*, and the histerid beetle *Haeterius brunnipennis*.

eggs hatch, the larvae burrow down into the nest, making a beeline to the brood chamber. The sluglike larvae develop inside the nest, where they feed on detritus or prey on developing ant larvae. Like ant social parasites, many species of *Microdon* produce chemicals on their exoskeletons that mimic the odor of the ant colony they are inhabiting. In the spring, the pupating *Microdon* larvae move up to the top of the ant nest, where they pupate and then emerge as adults, flying off to lay their eggs in new colonies. Most *Microdon* species are thought to be host specific. In New England, they have been collected from nests of *Camponotus novaeboracensis, Formica exsectoides, F. incerta, F. obscuriventris,* and *F. querquetulana*. To identify *Microdon* species, it is necessary to rear the larvae (or pupae) to adulthood and also to keep a specimen of the host.

Myrmecophilus crickets also live in ant nests, where they feed on secretions regurgitated by worker ants or obtain nourishment by licking the hydrocarbons from the ants' exoskeletons. Why *Myrmecophilus* is tolerated by ants continues to be studied and debated. The currently accepted explanation is that the cricket fools the host ants into thinking it is an ant itself

because some of the body parts of the crickets "feel" like parts of an ant. But eventually the ants detect the deception and hustle the cricket out of the nest.

Myrmecophiles are most diverse and abundant in the tropics; hundreds or even thousands of these ant lovers rely on the ever-moving nests of army ants for food and protection. Much less is known about our temperate-zone myrmecophiles, and new discoveries await your careful observations!

Ant Mimicry—Imitation Is the Sincerest Form of Flattery

The evolutionary and ecological success of ants has not gone unnoticed by other organisms, and ant mimics have evolved among spiders, wasps, plant bugs, and beetles, among other arthropods. Collectively, arthropods that look like ants are called myrmecomorphs because they have the form (*morpho* in Greek) of ants (*myrmecos* in Greek). Evolutionary ecologists recognize two broad classes of mimicry—Batesian mimicry and Müllerian mimicry. In both types of mimicry, the species being mimicked (the model) is usually aggressive or distasteful to predators. The difference between the two is that Batesian mimics are harmless and good to eat, whereas Müllerian mimics share the aggressive or unpalatable characteristics of their models. A third type of mimicry, specific to ant mimics, is Wasmannian mimicry. Wasmannian mimics not only resemble the shape and size of their models but also have evolved behaviors and chemical cues that allow them to masquerade as ants and live within the ant colony itself. Wasmannian mimics are known mostly from the tropics.

Ants are good models for evolutionary mimics. Many ants have stingers or poison glands and are aggressive when disturbed. Others are not especially tasty. The bright coloration of many ant species may be a warning to predators to stay away, and mimics take advantage of this early warning system. Most myrmecomorphic spiders are palatable Batesian mimics, whereas the "velvet ants" (Figure 2.7), which are actually wasps in the family Mutillidae, are brightly colored Müllerian ant mimics whose stings can be quite painful.

The greatest diversity of ant mimics is in the tropics, where there are also the most ant models. But there are many species of myrmecomorphs in New England. Most are "jumping" spiders in the family Salticidae; their characteristic jerky movements closely resemble the walking behavior of ants (Figure 2.8). We once collected one of these spiders, *Synemosyna formica*, in a Maine bog. Until we returned it to the laboratory and put the specimen under a dissecting microscope, we were sure it was a bog ant (*Myrmica lobifrons*)!

Perhaps the most curious of our New England ant mimics is the plant bug *Orectoderus obliquus*, in the family Miridae of the order of true bugs (Hemiptera). Like other Hemiptera, *Orectoderus* has hemimetabolous development.

Figure 2.7. Velvet ants in the wasp family Mutillidae often are mistaken for fast-moving ants. Drawing by Elizabeth Farnsworth.

Figure 2.8. Some ant mimics and their models. The three jumping spiders (Salticidae) on the left (top to bottom: *Synemosyna formica*, *Sarinda hentzi*, and *Peckhamia* sp.) are remarkable mimics of the ants on the right (top to bottom: *Myrmica* sp. AF-smi, *Camponotus nearcticus*, and *Formica querquetulana*).

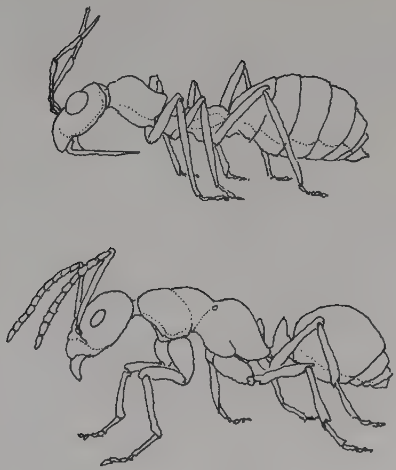


Figure 2.9. The mature *Orectoderus obliquus* (top) closely resembles *Formica incerta* (bottom). Drawings by Elizabeth Farnsworth.

That is, unlike ants and other holometabolous insects that go from eggs to larvae to pupae to adults, the hatchlings of true bugs and other hemimetabolous insects look like small (albeit usually wingless) versions of the adults. Each time they molt, they are a little larger and closer to the adult form. *Orectoderus obliquus* has combined hemimetabolous development with Batesian mimicry in a novel way: the different stages (or instars) of *O. obliquus* mimic different ant species! The small, young instars mimic small ant species in the genera *Leptothorax* and *Tapinoma*. Middle-aged, intermediate instars mimic medium-sized ant species in the genus *Crematogaster* or smaller species of *Formica*. The adult, wingless females mimic large *Formica* species (Figure 2.9).

Not only does the shape of an *O. obliquus* individual change as it matures, but its movement in each instar closely matches the movement, especially the running speed, of its ant models. We caught what we were sure was a *Formica subsericea* worker running across a north-central Massachusetts grassland, only to discover that it was *O. obliquus* as soon as we looked at it through a hand lens. The piercing and sucking mouthparts of *Orectoderus* (and other true bugs) distinguish this behavioral mimic from ants, which have chewing mandibles.

This brief overview of the ecology, evolution, and behavior of ants only scratches the surface of the intricacies and idiosyncrasies of ant life histories. Many of the books and articles listed in the Bibliography provide much more detail on the ecology and evolutionary biology of individual ant species. But the best way to discover how ants work is to go out in the field and see them yourself.

3. Observing, Catching, and Collecting Ants

Observing Ants

This field guide focuses mostly on collecting and identifying ants, but you can learn a lot more about their natural history, ecology, and behavior by studying them—alive—in the field. Ant workers often are specialized for foraging, recruitment, and nest defense, and they exhibit a rich array of behaviors that you can easily observe. With only a couple of exceptions, there are no ant species in New England that can seriously bite or sting you, so you shouldn't be shy about interacting with them. But first you have to find them.

Good Ant Habitats

Where should you look? Your first impulse may be to find a "pristine" patch of mature New England forest. But in reality, as we discussed in Chapter 1, there is no such thing, because all habitats in our corner of the world have been affected by centuries of human activity. Moreover, intact forest is not necessarily the best habitat for finding different ant species. Ants are thermophiles—they love warm sites, especially those with protected microhabitats for the establishment of safe nests. Forests, with their dense, leafy canopies, can be quite chilly. For warm temperatures and variable habitats, grasslands and ecotones—the boundaries or margins between different habitat types—are excellent places to start hunting ants. Edges of open fields, campgrounds, picnic areas, parking lots, and even sidewalk cracks and brickwork are all prime habitats for collecting ant species.

Good ant hunting also can begin at home! We hope that you don't have too many ants in your house, but your garden and the grounds around your house are ideal places to find them. Even a tiny yard with a concrete slab probably has at least two or three species. If you have trees, shrubbery, flowers, or vegetables planted, it won't be hard to find six or more species. Despite a long history of myrmecological work in New England, many areas have never been sampled (see Chapter 6). It would not be surprising to find a new regional, state, or county record from your garden samples, and there is even the possibility of finding a new species, one previously undescribed by science. Increasing our understanding of backyard biodiversity is also an important tool for detecting ecological changes associated with long-term climatic change and for teaching ourselves and our children to appreciate and understand the world around us.

Finding Ants

One way to find ants is to actively look for them. Ants nest and forage for food in vegetation, leaf litter, and soil; on tree trunks and leaves; inside grass stems, acorns, hollow twigs, downed branches, and rotting logs; and under stones and manufactured objects such as flower pots, garbage cans, and old tires resting on the soil surface. Search these microhabitats actively for ants, and you will find them. If you carry a 10× or 15× hand lens with you, you can see many features that will help you to identify ants to the genus level in the field (see Chapters 4 and 5).

The activity of ants leaves characteristic signs that you can learn to recognize. Anthills (Figure 3.1) and ant mounds (Figure 3.2), which are the result of ants' bringing buried mineral soil and nest debris up to the surface, look like volcanic cinder cones of soil or fine sand. These can range from the very small anthills (<5 cm diameter) of *Lasius neoniger* or *Pheidole pilifera* to the large mounds (>1 m diameter) of *Formica exsectoides*.

The workers of some ant colonies may use the same trails every day to forage for food or raid other nests. Millions of steps by millions of tiny ant feet, along with active clearing and stomping, compact the soil on these trails, which can be clearly visible where they cross otherwise untrammeled ground. Piles of sawdust at the base of a tree suggest carpenter ants (*Camponotus* species) working away inside it (Figure 3.3), and small drill holes in acorns (Figure 3.4) are the doorways for workers of tiny colonies of *Temnothorax* species.

Figure 3.1. These small volcano-shaped anthills of the Labor Day Ant (*Lasius neoniger*) are only about 5 cm across.

Figure 3.2. Dozens of these large mounds of the Allegheny Mound Ant (*Formica exsectoides*) fill a clearing near the summit of Mount Grace in Warwick, Massachusetts. This field of ant mounds has been here since at least the early 1970s.

Figure 3.3. Eastern Carpenter Ants (*Camponotus pennsylvanicus*) have left a pile of sawdust at the base of this oak tree.

Figure 3.4. A small hole in last year's acorn opens into the nest of the Doubtful Ant, *Temnothorax ambiguus.*

Instead of actively searching for ants, you could find a comfortable place and sit still for a while. Look around. Clear the twigs and leaf litter from a small patch on the forest floor, and watch it patiently. You will soon be rewarded with a view of one or more ant workers traversing the open space you have created. If you toss a handful of leaf litter into a white pan, you will usually see ants crawl out in all directions as they try to escape. Other insects are in the litter, too, and some may superficially look like ants (see the discussion of mimics in Chapter 2). Do not be deceived. Once you start to appreciate the details, you will find that ants look and move differently from most other insects. The first two segments of each antenna—the scape and the funiculus—are joined at a distinctive flexible "elbow," which is visible from a distance; the scape is also very long relative to any of the segments of the funiculus (see Chapter 4 and the inside back cover for further discussion of these body parts and others mentioned later in this chapter). Contrast this with the antennae of closely related wasps, which have no bend and have segments more or less equal in size. Ants also walk like . . . ants! They have a distinctive scurrying, side-to-side, zigzag gait that is unlike that of other insects (note that the primitive poneroid ants slither more than they scurry). The more you watch them, the more you will get a feel for the ant gestalt.

Still another strategy for finding ants is to attract foragers to food baits. On a small piece of stiff white paper or cardboard, put a small spoonful of tuna fish or a pile of crumbled cookies (myrmecologists traditionally use Pecan Sandies, which include a generous mixture of fats and sugars, keep well in warm weather, attract ants, and stave off your own hunger if you

miss lunch). Once a single forager finds the bait, she will recruit additional workers from the nearby nest. If you are lucky, you may even get to observe combat between different species that compete for these patches of food. However, such encounters are relatively infrequent in the cool forests of New England, where the densities of ants (and most other insects) are much lower than they are in the warmer forests farther south.

Because the ants from a single colony work in a coordinated fashion to bring food back to their nest, you may be able to find ant nests by following the trail of foragers returning with pieces of bait. Just as different ant species have different shapes, sizes, and morphology, they also have specialized behaviors and distinctive nests. With an inexpensive digital video camera, you can film nest entrances and worker behavior for many different species. Creating a catalog of these films would make an excellent student or class project, and the results would help myrmecologists to better identify species in the field from living material.

You can create a special opportunity for observing ants by building an ant farm. Take a large glass jar, an old aquarium, or a plastic tub; add soil and a cotton ball soaked in water (to provide moisture); and then carefully shovel up an entire ant colony (including the queen) and place it gently into the container. Cover the container with a fine mesh (bridal veil or toile fabric works very well) so the ants get plenty of air but can't escape. If you are careful about feeding and watering this ant farm, you should be able to keep a colony going for many weeks while you observe tunnel construction, feeding behavior, and brood care in great detail. There are many Web sites and YouTube videos (see Internet Resources) available with details on how to set up your own ant farm.

Collecting Ants

Accurately identifying ants requires that you collect and sacrifice individuals. The information you get from specimens that have been collected and properly curated can be of real value to the broader scientific community. Ant collections provide documentation of when and where an individual species was foraging or nesting. These data form the basis of species distribution maps like those in Chapter 5 and are used by scientists to understand how ants may respond to ongoing environmental and climatic change. So collecting ants, or any other insects, is a serious undertaking with broad scientific and societal importance.

The Tools of the Trade

Before you begin collecting ants, you will need a few basic supplies (Figure 3.5). For species identification, ants need to be killed and preserved in 95% ethanol

Figure 3.5. The basic supplies for ant collecting include a small trowel to excavate nests, a pocket knife to cut open twigs or acorns to reveal hidden colonies, a white plastic sorting tray, one or more small sealable plastic boxes in which to store live ants, baits, hand lenses, vials and labels, ethanol in which to preserve the specimens in the field, a global positioning system (GPS) unit to determine the precise location at which you found the specimen, and a notebook in which to write field data and your observations.

(ethyl alcohol). Because ethanol is the main ingredient in alcoholic beverages and is added to gasoline to reduce air pollution, it is tightly regulated, heavily taxed, and sold only by licensed chemical companies. It is also highly flammable and must be stored in fire-safe containers. If you can't team up with a researcher at a nearby technical school, college, or university who can provide you with a small quantity of ethanol, you can use Everclear grain alcohol (190 proof), which can be purchased from your local purveyor of fine spirits or via the Internet. In a pinch, you can use vodka, gin, tequila, or the rubbing alcohol (isopropyl alcohol) in your medicine cabinet, but specimens killed in any of these alcohols will degrade rapidly and should be promptly transferred to 95% ethanol or, better, dried and pinned (as described later in this chapter). *Do not* use the denatured alcohol that you can buy behind the counter from some pharmacies or medical supply stores. Denatured alcohol contains methanol (methyl alcohol), which is very poisonous.

In addition to your supply of ethanol, sampling vials are indispensable for storing ant specimens. We prefer 2-mL plastic vials with screw-top lids and rubber O-rings that minimize evaporation, but any small leakproof vial

will do. Add about 0.5 mL of ethanol to each of a dozen or more sampling vials so that you don't have to carry a container of ethanol while you collect. Stuff your pockets or your day pack with these vials so that you'll have them when you need them.

White paper and a pencil or alcohol-resistant pen (such as a very fine-line [#005] Pigma Micron pen, available for a few dollars at any art supply store) can be used to make simple, but temporary, labels for your vials while you are in the field. We find it easiest to precut the paper into vial-sized strips before we go into the field so we don't have to fumble for a scissors every time we collect an ant. A couple of hundred of these precut labels, stored in a small sandwich bag, will last a long time. You may also want to carry a 5×, 10×, or 15× hand lens for looking at specimens in the field; a small hand trowel for turning over stones and logs; baits and the cards to put them on; and a white plastic or metal pan along with a plastic or metal mesh screen (2 mm diameter) for sifting samples of leaf litter (Figure 3.6).

Figure 3.6. A simple and inexpensive litter sifter based on a design by Mark Deyrup. This one is made from two white plastic trays; 3-mm (eighth-inch) mesh hardware cloth; a few nuts, bolts, and washers; and a silicon seal. Cut the bottom out of one of the trays, attach the hardware cloth using nuts and bolts (the washers, which are larger than the mesh, keep the nuts from slipping through the mesh), and seal the edges with silicon to prevent ants from escaping and so you don't cut yourself on the sharp edges of the hardware cloth.

Finally, a portable global positioning system (GPS) unit for recording your exact location, a small digital camera for site photographs (GPS apps and digital cameras are available in many so-called smartphones), and a field notebook to record observations and label information are the remaining tools of the trade.

Catching Ants

Some myrmecologists collect ants with an aspirator, or "pooter," which consists of rubber, plastic, or metal tubing; a large plastic collecting chamber; and a two-holed rubber stopper (Figure 3.7). This Rube Goldberg apparatus will allow you to suck up ants into the collecting chamber; a tiny screen prevents the ants and debris from entering your mouth. Some pooters deposit the ants directly into an alcohol-filled vial (Figure 3.7). If you use one of these, keep it vertical lest you find yourself swallowing the alcohol or inhaling the fumes! However, pooters are yet another thing to carry, and they are not easy to use on damp forest floors or soil surfaces. Furthermore, if you are collecting large Formicinae species (especially in the genera *Camponotus* and *Formica*), you may end up inhaling formic acid, which some species spray as a defense against predators and zealous myrmecologists. Inhaling formic acid in small doses won't hurt, but it isn't pleasant! You can

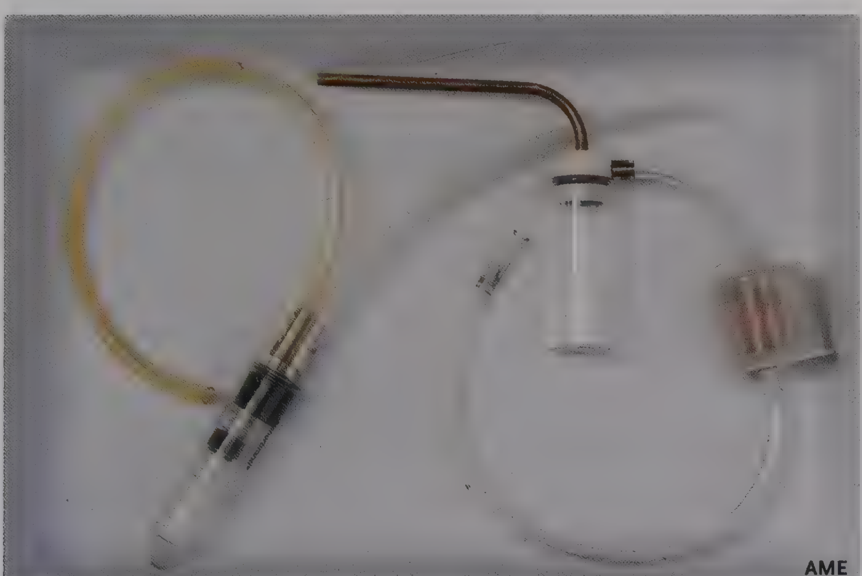


Figure 3.7. Two different kinds of pooters. The one on the left directs the ants into an alcohol-filled vial. The one on the right directs the ants into a dry vial. The latter is equipped with an in-line automotive fuel filter to reduce the effects of formic acid on your lungs.

incorporate a fuel filter into your pooter to reduce the amount of formic acid entering your lungs.

We find it much easier to collect ants directly by hand, snatching the workers up between thumb and index finger. Many workers move very quickly and are marvelously adept at avoiding predators, so hand-collecting requires patience and hunting skill (or video game experience). Wetting your fingers with a drop of saliva may increase your capture success, although it can be a little messy. Alternatively, you can wet the tip of your index finger with a drop of ethanol (from one of your sampling vials) and touch a running worker with your fingertip. This should get the worker a little tipsy and slow it down enough so you can grab it. Finally, you can toss an ant, along with leaf litter, into a white plastic tray. When the ant moves out of the litter, gently pick it up and leave the debris behind.

Once you have the specimen in your fingers, hold it securely but gently so that you don't damage it with too much pressure. Using your free hand (or your teeth), open up one of your sample vials and transfer the ant to the vial. You may have to seal your index finger over the opening and shake up some of the ethanol to catch the ant, which will expire in the ethanol after 5 or 10 seconds. You should immediately add a uniquely numbered label to your sample jar and record field notes on the microhabitat, soil, and/or vegetation in your notebook. Use your GPS unit to determine the latitude, longitude, and elevation of the sample, and record those data, too.

Hand-collecting is not the only way to catch ants. Myrmecologists often use arrays of bait stations, pitfall traps, or specialized devices for extracting ants and other small arthropods from leaf litter. Pitfall traps usually consist of plastic cups buried flush with the soil surface and filled with a few milliliters of soapy water, propylene glycol (antifreeze), or ethanol. Litter sifters are mesh bags or screens used to separate coarse twigs and whole leaves from the fine material in which ants can hide. The sifted litter can be put into Berlese funnels or Winkler sacks (Figure 3.8). As the litter dries from the top down, the ants burrow deeper into the remaining moist litter, eventually falling into the killing jar at the bottom. However, these methods all are more expensive and labor-intensive than hand-collecting, and all have much greater, often unwanted, environmental impacts. Hand-collecting can provide useful quantitative data if you search a fixed area (such as a square or grid of known dimensions) for a standardized amount of time. However, even without such standardized sampling, the ants you find by hand-collecting still can have a valuable scientific function—if you properly label and store them!

If you come across an entire nest, it is useful to collect at least three to six workers, because it can sometimes be hard to make a correct identification from a single specimen. You may want to collect the queen of the colony if she is present, but stop and think about it first. Queens are recognizable in the

Figure 3.8. Winkler sacks (left) are used to extract small ants and other invertebrates from leaf litter. The leaf litter is placed in the top of the sack, and as it dries, the small ants fall down into an alcohol-filled jar tied to the bottom of the sack. Before the litter is put into the Winkler sack, coarse material can be sieved out in a litter funnel (right).

field because they are usually larger than the workers and have distended gasters (because they are constantly laying eggs) and large thoracic segments (especially the mesonotum and metanotum) to support the wing muscles. However, if you collect the queen you likely will kill the entire colony, because the workers quickly die off without the queen present. In contrast, collecting only individual workers is more like collecting leaves from a single tree. But there is no getting around the fact that, in order to identify ants to the species level, you have to catch and kill some of the workers. For some species, such as the ants in the *Formica microgyna* group or workerless social parasites such as *Leptothorax wilsoni*, it may be necessary to collect the queen and even some males to make an accurate identification.

If you are actively collecting by turning over stones, digging in the soil, or opening rotting logs, be sure to put the stones back, fill in the holes, and

restore the microhabitat after you have searched so as not to ruin the entire remaining nest! These structures are part of the ant's habitat, and you should be very careful to minimize your ecological footprint wherever you are collecting. Because the number of ants and ant colonies is vast, little ecological damage is probably caused by the loss of individual workers or even a few colonies (unless you have destroyed the microhabitat). At the same time, many ant species are locally rare, and others are even listed as Vulnerable to Extinction in state, national, or international lists of threatened and endangered species (see Chapters 4 and 5). Colonies and queens of vulnerable or endangered species probably should not be collected. But regardless of whether you are collecting common ants or rare ones, it is important to keep in mind the ethical issues involved in collecting and killing living organisms.

Building an Ant Collection

Once you have gotten your specimens home, you will not want to store them very long in the vials of ethanol. The ethanol is flammable, the vials take up space, and the ethanol continually evaporates and has to be replenished. In addition, colors fade and the specimens become brittle after being in ethanol for a long time. Finally, ant specimens can be identified accurately only when they are dry; it is impossible to see the various hairs and fine sculpturing on the body of a wet specimen.

Pinning and Labeling Specimens

For accurate identification and permanent storage, you need to dry out the specimens and pin them (Figure 3.9). Pinning ants (or other insects) means carefully gluing the underside of the ant's mesosoma to a triangular point punched out of stiff paper (heavy-duty, acid-free cardstock available from office supply stores works fine). The point is then stuck through with an insect pin (size #1 or larger), which can then be stored and the ant displayed in an insect box (a cardboard or wooden box lined with Styrofoam for inserting the pins). Pins, punches, and storage boxes can be purchased from entomological supply companies (see Internet Resources).

In addition to the pinned specimen, the insect pin should also include labels. Traditionally, each pin gets three labels: The top label includes the locality where the ant was collected (country, state, county, town, latitude, longitude, and elevation) and the date of collection. The middle label includes information on the habitat. The bottom label includes the scientific name of the ant (genus and species), the name of the person who determined the identity of the specimen, and the date it was identified. Pinning is an art, and perfection can be achieved only with patience. Different myrmecologists

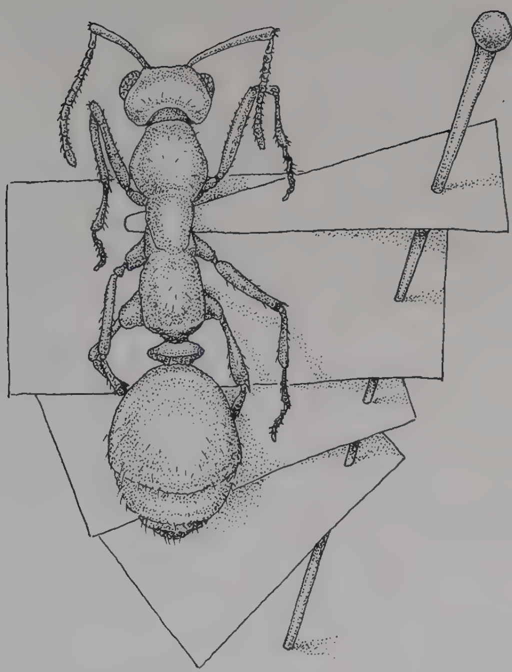


Figure 3.9. A correctly pinned ant faces forward to the left of the pin. The labels describe where the specimen was collected and by whom. Drawing by Elizabeth Farnsworth.

use different tools and techniques. The debates over whether to use hide glue or white glue or whether to apply glue to the point with a pin or dip the point into the glue can reach nearly the same intensity as debates over whether the Boston Red Sox or the New York Yankees are the better team. Many excellent Web sites and YouTube videos illustrate insect-pinning techniques (see Internet Resources).

Illustrating Ants

There is probably no better way to get up close and personal with an ant than to take the time to draw it. The muscle memory involved in drawing an ant helps you remember its key features. Familiarity breeds fascination, too—you really begin to appreciate the intricacies and beauty of ant anatomy when you have to look closely enough, and long enough, to render it on paper. Drawings also add important information to your field notes. Sketching the location and form of an ant nest, for example, helps you recall its particular features and thus potentially recognize it when you encounter another nest.

For drawing in the field, a mechanical pencil is handy. (Break a lead? No problem—there's more inside!) Given the unpredictability of New England weather, uncoated (i.e., nonplastic) waterproof paper is also useful, and several suppliers offer a variety of lined and unlined waterproof paper

notebooks. Alternatively, a thin marker like a fine Sharpie or Pigma Micron pen can be used with just about any paper as long it's not wet, and it gives a lovely, nuanced line.

It's fun to sit and watch all the activity around an ant nest while sketching the nest and its surroundings. The ants themselves may scurry around, and you may be convinced that it's impossible to draw them when they're in their feeding frenzies. But in reality, this is no harder than drawing any other mobile animal. Watch for a while. The quieter you are, the more fearless the ants become, and any initial agitation they exhibited when you first arrived will quickly subside.

Make a few very quick and simple sketches of a worker during one of her brief coffee breaks. Sketch in her gaster to start, because it is usually the largest part of the ant and the easiest to see. Once that's down on paper, the sizes of the other parts—the head, the mesosoma, and the petiole (if you can see it)—relative to the gaster start to make sense. The head is usually almost the same size as the mesosoma, which is usually about two-thirds to three-fourths the size of the gaster. The legs are surprisingly long, which explains why ants can move so fast and blithely through the landscape. And the antennae on some species can be longer still, reaching out well in front of the head. Draw what you see, and trust your eyes; don't worry about making your drawing look like an ant. If you pay attention to proportions, the drawing will make itself (Figure 3.10).

Once you become adept at catching an ant in your fingers, you can bring her up close and note details and accurate lengths by observing her through your hand lens. Take your time; she may squirm a bit but will be unharmed by your close inspection (plus you'll get a really good look at her biting mandibles!). Note the length of the antennal scape relative to the length of her head. Is the gaster a different color (or colors) from the head or the mesosoma? Is she hairy or shiny? What color are the hairs, and where do they occur? Is there texturing in the form of bumps, dimples, or fine striations on her body or face? Make some notes about her features. You'll be surprised how much you remember when you go to add these details to your drawing, even after you've let her go. (Note: You may occasionally snatch up a winged ant among the crowds that looks truly weird in comparison to the workers you have just sketched. Chances are this is a male, and these bizarre creatures can challenge the skills and aesthetic sensibility of even the most experienced artist! But these rare finds are special and fun to draw.)

Once home, if you have the luxury to view an ant under a dissecting microscope, you can draw her at leisure and really begin to appreciate her form. It takes practice to draw your specimen when you have to look back and forth between the microscope and the paper. And you need to take care that the lighting does not distort her features or color. With fancy, microscope-mounted cameras, which we describe in the next section, you

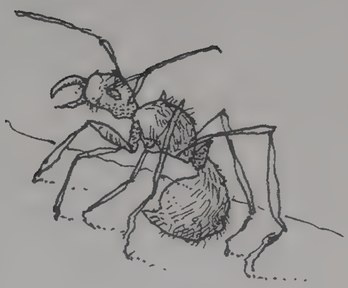


Figure 3.10. This quick sketch of a carpenter ant captured the essential details, such as the shape of the promesonotum and the location and length of erect hairs. Field drawing by Elizabeth Farnsworth.

can take a series of photos from which you can draw your ant. Some cameras connect to a computer so you can see the image projected on a large screen and sketch from that.

Using pen and ink is a precise way of rendering the outline and details of the ant's anatomy without worrying about color and shading. While making a simple pen-and-ink drawing, you will begin to notice characteristics such as facial features (eye size, hairs on the scape, number of teeth on the mandibles, etc.) that are used as diagnostic features in the keys for this book. Progress to a pencil, and you can show shading and three-dimensionality, giving real life to your ant. Medium-soft leads from 3B to 6B give a sensitive, rich darkness that can then be smoothed using a hard brush or a "stomp" of compressed paper shaped like a pencil. With a pencil you can also show texturing on various segments of the body. For a very smooth look, you can use graphite scrapings from a soft pencil, applying them with a fine brush and building up layers of this carbon dust to achieve deep tones. It is challenging to depict hairs, which often show up as white or metallic against the dull background of the gaster. Consider using opaque white paint with a fine brush to draw these in once the body is complete. Some artists use scratchboard, a board coated with (usually) dark, etchable ink into which lines are carved with an X-Acto knife or other fine blade. In this technique, white hairs and other highlights are gradually stippled or cross-hatched in while the naturally dark areas of the ant are left untouched on the board.

For fully illustrating an ant, though, color is essential. Watercolor pencils are easy to control and blend to give a smooth, three-dimensional look. Keep your leads sharp, and you can even draw the ant nearly life size (i.e., tiny) while showing diagnostic details, as in the drawings in the matrix keys in this book. Or use a lightly wetted brush on watercolor paper to create a painterly look.

Illustrations can be very useful for expressing and emphasizing these key features in a way that photographs of a squirming or pinned ant cannot, and also for conveying the real beauty of these amazing creatures. You don't have to be an artist to make informative, lovely drawings—all that's needed

is practice and patience. Who knows? You might start with ants and launch a whole new vocation!

Photographing Ants

Many excellent amateur photographers are interested in capturing images of ants and other insects. Searching for ants outdoors, discovering their biology and behavior, and photographing them can be a very enjoyable experience. Many Web sites (see Internet Resources) bring together communities of myrmecologists and entomologists who can help identify the ants based on photographs posted to the sites.

To take photographs that provide enough resolution so that the species can be identified from a photo alone, you will need a digital camera. To start, you can use cell phone cameras or digital point-and-shoot cameras, which, if used carefully, can yield photographs with sufficient magnification to identify the ant genus and, in many cases, the species. Cell phone cameras aimed through hand lenses or that have clip-on macro attachments can capture nice photographs of ants that are at least 3 mm long (such as our common *Camponotus, Formica,* or *Myrmica* species). If you use a point-and-shoot camera, the key feature to pay attention to is the minimum focusing distance. In general, this should be 30 mm or less, and if you focus through a high-quality magnifying lens, you can get reasonably good photographs of even smaller species.

To take photographs with great image quality, though, you will need to move up to a single-lens reflex (SLR) camera, a macro lens, and a high-speed flash to capture fast-moving individual ants. Wonderful ant images obtained with strobe flashes and a macro lens attached to a digital camera can be the start of an expensive, even addictive, hobby. All the photographs in this field guide were taken with either Canon or Nikon digital SLR cameras, macro lenses that provide images from one to five times life size, and one or more strobe flashes.

Image quality depends critically on lighting. Using a flash on shiny ants normally requires a diffuser (a white, translucent piece of plastic) placed over the flash to even out and soften the lighting. The background is also very important; photographing ants on dark soil does not produce as clear an image as photographing ants resting on clean sand, leaves, or other uniformly light-colored surfaces. To improve your chances of taking good photographs, work early in the morning when the day is still cool and ants are moving slowly. Cloudy days are better than full-sun days. Try to place yourself between the ant and the sun to reduce glare, but avoid casting shadows that can spook the ants. Compare your photographs with similar ones available on the Web that others have taken with similar equipment.

Most nature photographers will happily share their experiences and expertise and give you tips to improve your photography.

You will have to remain prone on the ground to capture images of many New England ants. This means you'll need rugged field clothes, insect repellent, and a brace for your camera. Remember to tuck long pant legs into socks to keep ants (and ticks!) out. A piece of wood with a camera mount attachment often is all that is needed to protect the camera from dirt and debris.

Do not rely on the automatic settings that are the default for digital cameras. Rather, set all controls to manual, maximize the depth of field (use the highest *f*-stop possible), and set the macro lens so that all you have to do to focus is wait until the ant itself comes into view. Then you can point and shoot. Finally, always remember to collect a specimen from the colony you just photographed, and keep good field notes: record the locality and other information associated with each photo. If you want to keep your hands on the camera, use a voice-activated digital recorder to take your notes.

Pinned specimens also can be photographed through a microscope, and museum curators often take multiple images of them. Using computer software, these images can be combined into composite images that are in perfect focus and have a 3-D look. Such specialized photomicroscopic imaging systems are very expensive and usually not available to the general public. However, you may be able to volunteer your time and services at a university or museum that has an imaging system in exchange for the opportunity to process your own photographs.

With field notes and sketches, drawings and photographs, you are ready to identify ants. Let's go!

4. Identifying Ants

You've found your ant, photographed it, caught it, brought it home, pinned it, and drawn it. Now you want to know what it is. To identify an ant (or any other organism), you key it out. This field guide and its different keys are your tools for identification. We present traditional dichotomous keys with illustrations, pictorial matrix keys, verbal summaries of genera and species groups, and detailed descriptions of each species, each on its own page. This combination provides a suite of identification tools unavailable for ants (or most other animals) in any other region.

The family of ants (Formicidae) is divided successively into subfamilies and tribes, genera (the plural of genus), occasionally subgenera, and finally individual species, which can be organized into species groups or complexes (Box 4.1).

Ant Morphology

The differences in the many visible bits and pieces of the ant body, what scientists call morphology (from the Greek *morpho,* meaning form, + *lógos,* meaning study or research), are used to distinguish among the different subfamilies, genera, and species. We describe here the ant body parts that you will need to know and use to identify specimens collected in New England; all of these parts are illustrated on the inside back cover of the book. Each term is in **boldface** type when first introduced, and all boldfaced terms appear in the drawings on the inside back cover. The terms are used throughout the keys. However, other morphological characters may be used for identifying ants in other parts of the world.

It is also important to be aware that individual ant specimens will differ in their overall size and color. Their size can depend on when the ant was born (for example, individuals from the founding brood of nantic workers will be much smaller than the average sizes given in the text), the caste to which the ant belongs (minor worker, major worker, queen, or male), or when she last ate (the size of the gaster will depend on the most recent meal). The body color may darken as an individual worker ages, and often fades or changes completely in preserved specimens (see Chapter 3 for more information on maintaining an ant collection). Although color and size differences can sometimes help you to separate some species from one another, they can fool or mislead you; morphological characters are much more useful and reliable, and you should invest the time it takes to learn the names of the body parts that are used to identify ants.

Box 4.1. Organizing the Ants

Taxonomists are scientists who describe and name organisms. Ant taxonomists organize the species within the ant family (Formicidae) in a hierarchy of groups, which is a finer-grained version of the classification of animals presented earlier in this book (see Box 2.1):

Family: Formicidae—the ants

Subfamily: Groups within a family that include a number of tribes or genera. Subfamily divisions are indicated by the suffix *-inae,* and there are six subfamilies of ants in New England: Amblyoponinae, Ponerinae, Proceratiinae, Dolichoderinae, Formicinae, and Myrmicinae.

Tribe: A division used to organize subfamilies that have many genera. Tribal divisions are indicated by the suffix *-ini.* For example, the tribe Camponotini of the subfamily Formicinae includes the genus *Camponotus.*

Genus: The primary taxonomic category that includes related species. It is always a capitalized Latin or Greek name, written in italics. So far, we have recorded 31 genera of ants in New England.

Species: A group of organisms that can successfully reproduce with other members of the same group. The species is the most important taxonomic category and is always written as a Latinate "binomial": two italicized words, the first of which is the name of the genus and the second of which names the species. For example, *Camponotus pennsylvanicus* is the official scientific name of the Eastern Carpenter Ant.

Based on recent evolutionary history or apparent similarity, closely related species can be organized into species groups and species groups further subdivided into species complexes. Examples of such organization in the New England ant fauna can be found in the genera *Aphaenogaster, Formica,* and *Lasius.*

Don't be intimidated by what seems to be a long list of named parts. By looking at the illustrations, working through the keys, and looking up the terms as you go along, you'll learn them in no time!

Characters of the Head

Let's start with the ant's **head.** The **compound eyes** of the worker ant are one of its most distinguishing features. They can be large or small and can consist of several to many lenses or facets, called **ommatidia,** that are used to collect light; the overall size of the eye and the number of ommatidia are important diagnostic characters in several genera. Many species also have three "simple" eyes, called **ocelli,** that look like small, raised dots near the top of the head; each **ocellus** has only one lens. Between the compound eye and the base of the mandible is the **cheek** (sometimes referred to as the **gena**), which may or may not have **erect hairs** of varying length and density. Erect hairs stick up and out from the head (or other parts of the body). In contrast, appressed hairs lie flat.

The segmented (technically, jointed) **antennae** originate from the head. The **condyle** is the rounded "ball joint" at the base of the antenna (see also Figure 5.1 on page 264); it sits in a rounded depression called the **antennal fossa** (plural: fossae) located on either side of the **front** of the head. In some species, the fossae are covered by the **frontal lobes,** whereas in other species (especially in the genus *Myrmica*), the fossae are exposed. The condyle is at the basal end of the *elongated* first segment of the antenna, which is called the **scape.** In some species, the scape nestles into a groove, or **scrobe,** that runs upward (technically, rearward) along the head. A raised edge of chitin (a **carina**) forms the rim of the scrobe. In workers and queens, the scape is much longer than the successive antennal segments (or **antennomeres**). Collectively, these smaller segments make up what is called the **funiculus,** and they join the scape at a pronounced angle, which gives the antennae their characteristic elbowed look. The last 2 to 4 segments of the funiculus may be swollen to form a distinctive **club.** The presence or absence of a scrobe, the total number of antennal segments (counting the scape *plus* all the segments of the funiculus; most worker or queen ants have 11 or 12 antennal segments, but some have as few as 6, and males often have 13), the presence or absence of a club, and the number of segments in the club are all characters that distinguish many ant genera. In the genus *Myrmica,* the base of the scape often is adorned with a protruding ridge, flange, or scoop (a small lamina or a larger lamella), and the shape and appearance of these laminae or lamellae are key characters used to distinguish among species.

The overall shape of the head is also important. Technically speaking, the ant's head is prognathous—the jaw (*gnathos* in Greek) protrudes forward

(Greek: *pro*) from the plane of the head—so what looks like the top of the head is considered by myrmecologists to be *behind* (posterior to) the rest of the head. As indicated in the illustration on the inside back cover, the location of each part is determined by this prognathous orientation: top is **posterior,** lower edge is **anterior**, front is **dorsal**, underneath is **ventral.**

Start by looking at the head in full-face view: look at the front (that is, dorsal view) of the head so that you can draw an imaginary plane in which the *y* (up-and-down)-axis runs from the top (posterior) edge of the head to the bottom of the **clypeus** (or "upper lip") of the ant and in which the *x* (left-and-right)-axis runs across the widest part of the head. Note whether the **top (posterior) margin** of the head in this full-face view is convex, straight, or concave and what kind of **rugae** (sculpturing) may be present. From the top of the head, move down (anteriorly) to the front. The width of the front—from scape base to scape base—is used to distinguish some species. The front of the head ends in the aforementioned frontal lobes.

Just below the frontal lobes is the clypeus. The shape of the clypeus is important: Does the center of the clypeus bulge out, or is it flattened? Is the lower edge, or **anterior clypeal margin,** convex, straight, or concave, or does it have teeth, a shallow **concavity** in the middle, or a deep central **notch?** Do the left and right ends, or **clypeal wings,** extend smoothly to the edge of the face, are they pinched in, or are they raised into a sharp ridge that forms, or connects to, the antennal fossae (like a waxed handlebar moustache)? Beneath the clypeus are the powerful jaws, or **mandibles,** which usually have conspicuous teeth (the number of teeth, which ranges from 0 to 8 or more, often distinguishes species or genera). The first, the **basal tooth**—the one at the top of the mandible just below the clypeus—may be offset from the line of all the others. The last, the **apical tooth**—at the anterior end of the mandible—is often longer than all the others. Beneath the head are the delicate, segmented **maxillary palps** and labial palps, which the ant uses to further sense the environment. The number of segments of the maxillary palps, along with their relative size, is an important character for distinguishing among species in the genus *Lasius.*

Characters of the Mesosoma, the Pedicel, and the Gaster

In ants, the segments of the **thorax** and the **abdomen** have been dramatically modified by evolution (see Chapter 2). You can see some of these modifications by looking at the **numbered abdominal segments** on the drawings on the inside back cover.

In adult ants, the first segment (I) of the abdomen (called the **propodeum**) is fused with the last segment of the thorax (the **metanotum**); this combination of the thorax + propodeum is called the **mesosoma.** The overall shape of the mesosoma, viewed in profile view (from the side) or in dorsal view

(from above), is often an important character used to distinguish among genera or species. For example, *Formica* and *Camponotus* are two of the most species-rich genera in New England. They are both in the subfamily Formicinae, but the profile of the mesosoma of *Camponotus* workers is always smooth and evenly curved (hump shaped), whereas the profile of *Formica* workers is always lumpy, angular, or "stair-stepped."

The thorax itself consists of the first three segments of the mesosoma—the **pronotum, mesonotum,** and metanotum. Sometimes we refer to the pronotum and the mesonotum together as the promesonotum. In queens and males, as in most other Hymenoptera and most other insects, the mesonotum and metanotum are large and accommodate the wing muscles. These large segments give the thorax a boxy appearance. Virgin queens and males have two pairs of wings. The first pair (**forewings**) are larger than the second pair (**hindwings**), and the patterns of veins in the wings can be used to distinguish among some genera. In contrast, the mesonotum and metanotum in the wingless worker ants are atrophied and comparatively small. Each of these segments supports one pair of legs. Each ant leg has a **coxa, trochanter, femur, tibia**, and a **tarsus**, ending in a pair of tiny **tarsal claws.** In some species, we note whether the tibia has erect hairs and whether the one or two **tibial spurs,** which protrude from the base of the tibia, have teeth.

The last segment of the mesosoma, the propodeum, corresponds to the first segment of the abdomen. Just beneath the propodeum is the **metapleural gland,** which secretes antibiotics that keep the ant exoskeleton infection-free. The propodeum of many species also has one or two pairs of **propodeal spines** that project upward or toward the rear of the ant.

The second segment (II) of the abdomen (and in some groups the third segment [III] of the abdomen as well), is constricted into a distinctive wasp waist, or **pedicel.** If the pedicel has only one segment, it is called the **petiole.** If it has two segments, they are distinguished as the (anterior) petiole and the (posterior) **postpetiole.** In New England, only ants in the subfamily Myrmicinae have both a petiole and a postpetiole; our other five subfamilies have only a petiole. In some genera of Myrmicinae, notably *Aphaenogaster, Stenamma,* and *Temnothorax,* the anterior (front) end of the petiole is substantially thinner than the rest of the petiole and extends forward; this thin, extended part of the petiole is called the **peduncle.**

The remaining segments of the abdomen together make up the **gaster.** Each of these sections has characteristic sculpturing (rugae), texture, and hairiness. The upper (dorsal) surface of each segment of the gaster is called a **tergite**, and the lower (ventral) surface of each segment of the gaster is called a **sternite.**

There are only a few useful diagnostic characters of the gaster. In the three subfamilies Amblyoponinae, Ponerinae, and Proceratiinae (together part of a larger group called poneroids), there is a pronounced **constriction**

between the first and second segments of the gaster. This constriction, along with its long, tapering gaster, makes a poneroid ant appear very wasplike. The genus *Crematogaster* has a distinctive heart-shaped gaster, and its postpetiole attaches nearer to the top (dorsal) surface of the gaster than it does in all other genera of ants, in which the petiole or postpetiole clearly attaches to the front (anterior) surface of the gaster. The color and arrangement of hairs on the dorsal surface of the gaster also can be diagnostic for many species. Look carefully at the end of the gaster. Ants in the Myrmicinae and in the three subfamilies of poneroids have a **stinger**; Formicinae have a tiny but distinctive **acidopore** (a nozzle often fringed with hairs) at the tip of the gaster; and Dolichoderinae have a simple **horizontal slit** at their tail end. Males have a pair of flattened appendages (**parameres**) at the end of their abdomen, but workers and queens never have these.

It will often be important to measure different parts of the ant. Measurements that we use throughout this book and that are used frequently by myrmecologists include the following:

Hair length: the length of an erect hair, usually on the head, pronotum, gaster, or tibia.

Head length: the distance from the top (posterior) of the head to the lower (anterior) edge (margin) of the clypeus when seen in full-face view.

Head width: the greatest width of the head when seen in full-face view. This measurement should extend to the outer edges of the compound eyes if they protrude from the side of the head.

Mandible length: the length of the mandibles, when closed, when seen in full-face view.

Mesosoma length (also called Weber's length or Weber's index): the length of the mesosoma, from the front (anterior end) of the pronotum to the rear (posterior end) of the propodeum.

Pedicel length: the length of the petiole, or of the petiole + postpetiole, seen in profile view.

Scape length: the length of a straight line (chord) extending from the base of the scape to where it joins the funiculus.

Total length: the length of an ant, stretched out. On pinned specimens, this would be the length of the mandible + the length of the head + the length of the mesosoma (Weber's length) + the length of the pedicel + the length of the gaster. Because specimens are often curved or contorted, the parts should be measured separately and then the individual measurements added together to get the total length.

Measurements throughout the book are given in millimeters (mm) for average workers (not nantics) and are best measured on pinned specimens

viewed under a dissecting microscope equipped with an ocular micrometer (described in the next section).

The Importance of a Microscope and Light

You may be able to see larger morphological characteristics and identify your specimen to the genus level using only a 10× or 15× hand lens and the illustrated key on the inside front cover of this field guide. However, you will probably need more magnification to identify which species it is. If the specimen has already been pinned (see Chapter 3), you can stick the pin in a piece of foam or cork or use a specialized manipulator that can rotate the pin in three dimensions so that you can more easily see all sides of the ant. If the specimen is still in alcohol, remove it from the vial and dry it on a paper towel for a few minutes. Then either pin it or use fine forceps (#4 or #5) to orient it under a dissecting microscope, and light it up with a good light source so that you can see the important morphological characters.

Dissecting microscopes (also called stereomicroscopes or binocular microscopes) have eyepieces (oculars) and objective lenses that magnify the specimen. Standard dissecting microscopes have objective lenses that range from 4× to 50× magnification when paired with 10× oculars, and this magnification is enough to identify most ants to the species level. With higher-powered (and more expensive) oculars (20× or 25×), the magnification would be increased to between 8× and 100× (with 20× oculars) or between 10× and 125× with 25× oculars. You may need such higher magnification to see, for example, feathery hairs on the gaster of *Lasius plumopilosus* or the teeth on the tibial spurs of *Myrmica* species. Ideally, one of the oculars should have an ocular micrometer in it. Micrometers are lenses etched with a scale so that you can measure specimens accurately. The scale of measurement depends on the magnification, so you will need to calibrate your ocular micrometer with a stage micrometer—a measurement scale of known size that you can observe through the microscope. In a pinch, you can put a ruler marked with millimeters under the microscope next to the specimen, but many features are measured in tenths or hundredths of millimeters, so a calibrated ocular micrometer is a better way to go.

Specimens viewed under dissecting microscopes are best illuminated with light reflected off the specimen from a dedicated source, such as a simple desk lamp. The under-the-base illuminator provided with many dissecting microscopes is designed to transmit light through a transparent specimen (such as an amoeba in clear water); it will not work for viewing ants. Fiber optic lights let you point a tube of bright light right where you want it. Ring lights mount underneath the objective and provide more even lighting. Some ring lights attach to your fiber optic light source; others have

light-emitting diodes (LEDs). The different types of lights—desk lamps with incandescent or fluorescent bulbs, fiber optics, and LEDs—have different "temperatures" that correspond to different parts of the visible light spectrum—as does the white balance setting on your digital camera. Ants look different under the different light sources—if you want to see an ant as it would appear in strong sunlight, use a fiber optic lamp. But the heightened contrast of an LED light source will highlight many subtle morphological characters.

You can also use a digital camera to take pictures of your specimen through the microscope (see Chapter 3). With care, you can take a good photograph simply by pointing your camera at the ocular. Some dissecting microscopes let you attach your camera over one of the oculars. Still others come with a third tube (and a third ocular) that lets you take pictures while you are looking through the oculars. To get accurate colors in your photographs, be sure to match the camera's white balance setting to the type of light you are using. It is also best to use the raw or tif setting on the camera instead of the jpg setting. Although the tif images are larger, they can be more precisely edited for color and white balance.

Really good dissecting microscopes and light sources can be expensive, but the better the optics and light source, the more you can see. Camera attachments add still more costs. You can hunt for bargains on the Web (see Internet Resources) or invest in a new microscope. The investment will pay for itself quickly, and if you take care of your microscope, it will last for your entire life.

Using Keys

If you've never played Twenty Questions or used dichotomous keys before, you may find their structure initially puzzling and perhaps unduly restrictive. But once you understand how they work, you will find that they provide a quick and straightforward route to accurate species identification.

Dichotomous means cut in two (it is derived from the Ancient Greek words *dikha,* meaning apart, + *temnō,* meaning I cut [it]), and dichotomous keys literally divide groups into two parts by presenting you with a series of either-or (yes-or-no) choices. As you work your way through the series of choices, you eliminate possible species one by one (or group by group) and hone in on the correct identification. Here we illustrate how to use a dichotomous key to identify one of our most familiar ants, the Eastern Carpenter Ant, *Camponotus pennsylvanicus.*

A dichotomous key consists of a numbered series of mutually exclusive choices, called couplets. The first couplet of our key to the subfamilies and genera of ants in New England prompts us to choose whether the gaster has a visible constriction between the first and second segments:

1a. **Gaster with visible constriction between the first and second segments** ....(Poneroids) 2
1b. **Gaster without a visible constriction** 4

If the ant has a constriction in its gaster, go to couplet number 2, but if it doesn't, go to couplet number 4. *Camponotus pennsylvanicus* has no constriction, so let's go to couplet number 4.

4a (from 1b). **Postpetiole absent** (pedicel has only one segment) 5
4b. **Postpetiole present** (pedicel has two segments).........Myrmicinae (16 genera, 61 species) 8

This couplet refers to the number of segments of the pedicel. But before reading this couplet, note the text in parentheses after 4a. This number tells you what couplet in the key led you here; in this example, that was couplet 1, part 1b. If you find yourself lost in a key—neither fork in the couplet matches the features of your specimen—you can always work your way back by following these numbered signposts. The indentation of the couplets also lines up with where you came from. Note that standard keys for animals do not have indentation, whereas those for plants do. In our experience teaching students who have never used a key before how to identify either animals or plants, we have found that the indentation helps, so the keys in this book are indented. Back up (and outdent) one or more steps until you come to a couplet about which you are confident. Then move forward again. If you are unsure which fork to take, try tracing down each of the two paths and see where they lead. Alternatively, if you have a good guess as to the species based on the matrix key or the species pages (described later), try working backward through the couplets from the endpoint, and see if the descriptions match.

We're not lost yet; because the pedicel of *Camponotus* clearly has only a single segment, move to couplet 5.

5a (4a). **Acidopore (a small nozzle, often fringed with hair, at the end of the gaster) present** ....Formicinae (8 genera, 62 species) 24
5b. **Acidopore absent**..Dolichoderinae (2 genera, 7 species) 31

Couplet 5 comes from couplet 4, part 4a. This is a terminal couplet—both part 5a and part 5b end with a definitive identification—either the subfamily Formicinae or the subfamily Dolichoderinae. *Camponotus,* with its prominent acidopore at the end of its gaster, is in the subfamily Formicinae. So now we are directed to jump to couplet 24, which will move us through the eight New England genera in this subfamily.

24a. (from 5a: Formicinae) **Antennae 9-segmented**; a very small, yellow ant (~1.5 mm long) .... *Brachymyrmex* (1 species—*B. depilis*), p. 109
24b. **Antennae 12-segmented**, total body length variable 25

25a (23b). **Mesosoma smooth, with a convex profile**; antennal insertions set well back from the top (posterior border) of the clypeus; acidopore without fringing hairs .... *Camponotus* (9 species), p. 111
25b. **Mesosoma profile not smoothly convex—when viewed from the side, the propodeum is lower than (stepped down from) the level of the promesonotum**; antennal insertions are at, or adjacent to, the posterior margin of the clypeus; acidopore with fringing hairs 26

Couplet 24 prompts us to count the number of segments on each antenna. Remember to count the scape! Most Formicinae, including *Camponotus*, have 12-segmented antennae. Couplet 24 also mentions color, but not in boldface type. This is a convention we use throughout the keys—the most important, distinctive character(s) is (are) in **boldface**. These characters are more distinctive, or less variable, than those described in regular type. It's not that you won't ever find a yellow (or yellowish) *Camponotus*, but you will never find a *Camponotus* with a 9-segmented antenna. So move to couplet 25.

Couplet 25 refers to the shape of the mesosoma, viewed in profile. Is it smooth or bumpy? *Camponotus* has a smooth mesosoma (as well as antennae that insert posteriorly on the head and an acidopore without fringing hairs), and part 25a directs you to this genus, on page 111. There you will find a description and key to the genus, where you will traverse another dichotomous key; this one will lead you to the name of the species. If you have used the key correctly (and if the species is one that is included in the key!), you will have arrived at the correct species identification. For *Camponotus pennsylvanicus*, you would follow the path in the species-level key from couplet 1 (1b: no notch or median depression in the center of the clypeus) to couplet 4 (4a: microsculpturing visible on the gaster) to couplet 5 (5b: long, golden hairs on the gaster) and finally to couplet 6 (6a: a black ant: *C. pennsylvanicus*).

A dichotomous key can be visualized as a branching structure with the species all occurring at the terminal branch tips. In a similar fashion, the evolutionary history of a lineage can also be depicted as a branching structure called a phylogenetic tree (see Chapter 2). In a phylogenetic tree, species also occur at the tips of a branching tree. However, the similarity between a key and a phylogenetic tree ends here. In the phylogenetic tree, the branch points represent events such as genetic differentiation and speciation that split lineages; the ancestor of the entire group (which may be extinct) occurs at the base. A dichotomous key does not necessarily use characters that changed during evolution, and the branch points don't necessarily represent evolutionary divergence. Instead, a dichotomous key

relies on the simplest and most obvious traits that lead to the quickest discrimination among different species.

We suggest that you first learn how to identify the subfamilies and genera of New England ants using either the illustrated key on the inside front cover of this field guide or the dichotomous key to the subfamilies and genera at the beginning of Chapter 5. After only a little practice, you will probably be able to correctly identify the subfamily to which your ant specimen belongs without even using the key. Next, use the key to determine which genus you have in the particular subfamily. Some genera have only one species (or only one species in New England), so identifying the genus is the same as identifying the species. Other genera have only a few easily distinguished species, whereas others have many similar-looking species. The most challenging genera are *Myrmica* (21 New England species) and *Formica* (31 New England species); the keys for these genera are complex, with many couplets to work through. In all cases, make sure that you have correctly identified the genus before tackling the species-level keys.

Don't despair if some specimens can't be identified at all. You may need to show them to an expert, and even the experts don't always agree! This is because there may be considerable variation in the appearance of a trait within a species and some of the character distinctions are quite subtle. Set aside difficult specimens and return to them later. As you gain experience and confidence, you may find that some of these unknown specimens become easier to identify. Then you will be able to keep your eyes open for "new" species that may not be described in the keys here. As the climate of New England continues to change over the ensuing decades, the appearance of new southern species in Yankee woodlands is a distinct possibility (see Chapter 6). If your specimen doesn't match anything in the keys, there is even a chance that it is a previously undescribed species, and therefore is new to science!

Matrix Keys

Although the dichotomous key has a long tradition in taxonomy, it is not the only means for identifying species. For the genera (or species groups) with four or more species, we also include a matrix key (Figure 4.1), which illustrates all of the species together. Each row represents a different species, and each column highlights contrasting characters, which are briefly described or defined for each species. The advantage of a matrix key is that you can scan all the character variations on a single page; comparing variations is more difficult with a dichotomous key. In all our matrix keys, the different species are drawn to the same scale so that their sizes can be compared relative to one another. More than one character can be shown in each drawing; for example, the first column of this matrix illustrates both

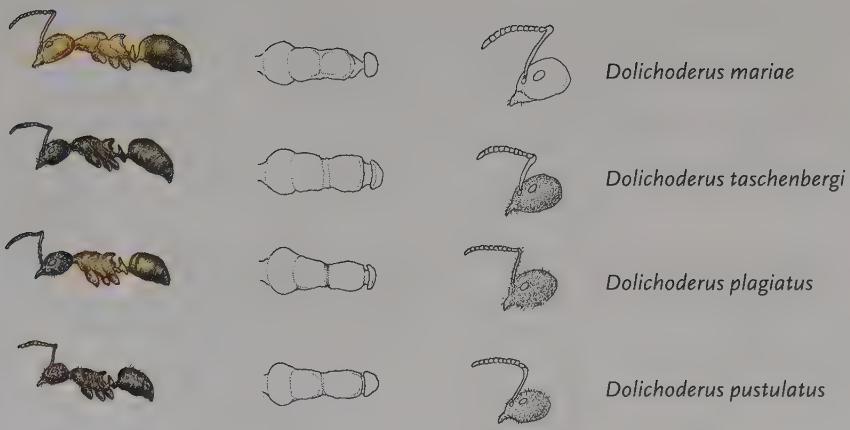


Figure 4.1. An example of a matrix key. This matrix depicts the four New England species of *Dolichoderus*. See Chapter 5 for more information on this genus.

the relative size of the ant and its most common color. Remember, though, that size and color can vary among ants from the same colony and that colors can fade or change in specimens stored in alcohol or pinned in boxes or drawers.

How to Use the Species Pages

The species pages in Chapter 5 are organized by subfamily—the three New England subfamilies of poneroids are described first, followed by the subfamilies Dolichoderinae, Formicinae, and Myrmicinae. Within each subfamily, the pages are grouped alphabetically by genus and then alphabetically by species within a genus. Colored tabs on the edges of the page indicate subfamily; different genera are distinguished by different shades of the subfamily colors.

The species pages follow a standard format (Figure 4.2). Color tabs on the edge of the page indicate subfamily (base color) and genus (shade). The Latin name of the species is given first, followed by the taxonomic authority —the last name of the taxonomist who described it and the year when he described it (surprisingly, none of the New England ant species has been described by a woman . . . yet!). If the taxonomic authority is in parentheses, it signifies that the name of the genus of that ant has changed since it was first described. But the original taxonomist's name is preserved—the only true route to immortality in science! If the species name is in **red, boldface** type, it is listed by the International Union for the Conservation of Nature (IUCN) as Vulnerable to Extinction on the International Red List of Threatened Species (http://www.iucnredlist.org), version 2010.4 (ants were last assessed for the Red List as Threatened or Endangered in 1996). If the

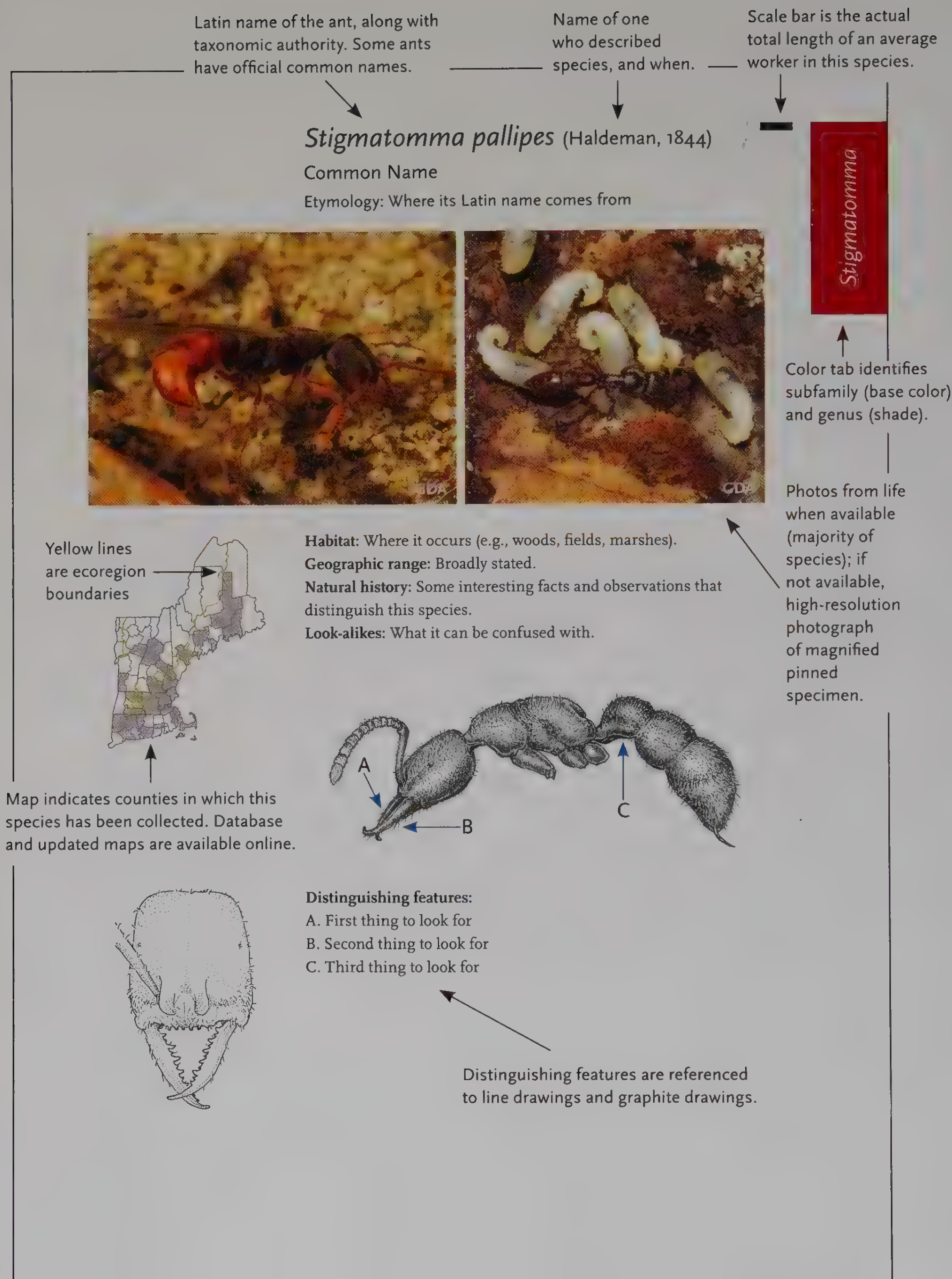


Figure 4.2. How to navigate the species pages.

species name is in **brown, boldface** type, it is a non-native species that has arrived in North America sometime in the past 100 to 200 years. Below the Latin name is a common name. For some species, there is an official common name suggested by the Entomological Society of America (http://www.entsoc.org); these are indicated by an asterisk (*) in front of the common name. For other species, we have suggested a common name based on the linguistic origin (etymology) of the scientific name.

For most of the species, photographs illustrate the ant in the field—including its habitat, nest, or a close-up showing interesting behaviors. These are described in more detail in the text box that summarizes the habitat of the ant species, its geographic range, some natural history facts, and look-alike species. Some of the species are rarely collected or very poorly known, and for these we have photographs of potential habitats or of museum specimens. If you find one of these species in the field, try to get a nice photograph of it and send it to us for use in subsequent editions of this field guide!

The distribution map indicates the New England counties in which we have confirmed records of the species. The dark yellow lines are the boundaries of the five ecoregions (see Chapter 1), the black lines are the state boundaries, and the counties are bounded in gray. Any county with at least one record of the species is filled in with light purple. If a species has not yet been collected in New England, we expand the map to include bordering regions of New York or Canada and indicate the closest specimen record with a single red dot. As we discuss in more detail in Chapter 6, we have many more samples of ants from some New England counties than from others. The absence of an ant species from a particular county may simply indicate that not much collecting has occurred in that county. Our database of locality records is available online (http://NEAnts.net/). Send us your new specimen records; if we can confirm your species identifications, we will add them to the database, enriching everyone's understanding of ants in New England!

The detailed drawings on each species page illustrate important features to look at in order to identify each species. Drawings highlight the key structures used for identification, and we note these features with lettered arrows. The faces and profiles are shown for all species; when especially useful, insets of other important body parts also are provided. Although drawn from actual New England specimens, the illustrations are nonetheless idealized because they deliberately call attention to the characters that are most useful for identifying the species. Legs and other body parts that don't have diagnostic characters are omitted from these drawings. For those genera with distinctive major and minor workers that have very different appearances, both majors and minors are illustrated. But remember, the drawings are idealized and represent only one or two specimens; they don't capture the variability seen in nature! So don't take them too

literally—always check your identification with the keys and other available resources.

Finally, the scale bar in the upper right corner of the page indicates the true size of an average full-grown worker of the species. Two scale bars are shown for species with distinctive major and minor workers.

Share and Enjoy!

Once you have gained some skill in ant species identification, share your knowledge by teaching your friends, family, and students. Books and field guides are not enough; like music, natural history knowledge stays alive only if it is used and shared.

5.

Descriptions of, and Keys to, the Subfamilies, Genera, and Species of New England Ants

This chapter summarizes our knowledge of the regional fauna. As of March 2012, we know of 31 genera and 132 species nesting somewhere in New England (three of which were described based on only a few individuals or a single colony and have never been seen since and 14 of which are not native to our region). Eleven other species and 1 genus discussed in this chapter have not yet been found in New England but have been found in a county of New York that borders New England or in habitats in nearby Quebec that also are part of the New England landscape. A checklist of the regional ant fauna is printed at the end of the book (p. 394) and can be downloaded from our Web site. These numbers are derived from our own fieldwork collecting and studying ants throughout the region, and from thoroughly scouring and inventorying collections—from the well curated to the unsorted (before we got to them)—in regional and national museums, university departments and broom closets, and individuals' desk drawers. Indeed, we have seen every one of these species, mostly in the fields and forests of New England, nearby New York, or southeastern Canada; a few of the vagrant tropical and subtropical tramps have turned up only in historical collections.

It has been no small task even to decide what names to use for some of the genera and species. We use the names of genera and described species that are given in the most current version of Barry Bolton's *Synopsis of the Formicidae and Catalogue of the Ants of the World,* which is maintained and updated regularly on the Web site of the Global Ant Project (see Internet Resources). As new species are found and existing genera are revised based on new data—especially gene sequences and other molecular information—the names of ants can also change. For example, based on new DNA evidence, the genus *Nylanderia* was separated out from *Paratrechina* while we were writing this book. Expert myrmecologists continue to disagree over the correct name for the genus *Pyramica:* is it *Pyramica, Smithistruma,* or *Strumigenys?* And 15 of the species we illustrate have no official names because they have not yet been formally described! Because this field guide is not a peer-reviewed taxonomic journal, we do not give names to these undescribed species. Rather, we refer to them simply as unnamed species or as a species "cf." (from the Latin imperative *confer,* meaning bring together, compare with, or near) another well-known species that the unnamed species resembles. We refer to the two undescribed species in the genus *Leptothorax* and the five undescribed species in the genus *Myrmica* with the codes that Professor André Francoeur of the University of Quebec at Chicoutimi

uses to reference them. His monographic revision of these genera and descriptions of these species should appear as a journal publication in the next few years.

So, despite the apparent authority of permanent ink on archival paper, this guide to the ants of New England represents only a snapshot: our understanding of the regional ant fauna in 2012. There is still much work to be done, by both amateur and professional myrmecologists, and everyone can contribute!

Identifying the Subfamilies and Genera of New England Ants

The first step in identifying an ant is to determine which subfamily and genus it is in. Most everyone can easily see the difference between a large and a small ant, or between a red and a black ant, but it is a significant accomplishment to distinguish among the 31 genera that occur in New England. The illustrated guide to the genera printed on the inside front cover of this book can help you, armed only with a hand lens, to identify the correct genus in the field. Hold the ant gently between the fingers of one hand; with the other hand, bring the hand lens up close to your eye. Now bring the ant up to the hand lens until the ant snaps into focus. Work back and forth between the ant and the guide to the genera until you think you have a match. To confirm your genus identification, you will probably have to examine the ant under a dissecting microscope and work through the subfamily and genus keys in this book.

Whether you are looking at the ant through a hand lens or under a microscope, there are some key features to look at first. In the dichotomous keys, these primary characters are indicated by **boldface** type. The secondary characters described in normal type will help you get a sense of the overall look and feel of the species, but these secondary characters will not, by themselves, definitively separate species from one another. As we discussed in Chapter 4, all the body parts of an ant have their own names—the illustrated glossary printed on the inside back cover includes all the parts we refer to in the text and the keys.

Start by looking at the body of the ant in profile. Do you have a worker ant or a reproductive ant? The latter can be either a queen (also called a gyne) or a male. Our keys and species descriptions are based on workers but will usually work for queens as well. Queens may or may not have wings (if they have already shed their wings, the base of each wing will still be visible), but both queens and males have prominent bulges on top of the thorax that support the wing muscles.

The males, with only a single set of chromosomes (recall the discussion of haplodiploidy in Chapter 2), almost always have wings and look very different from the queens and workers; for the connoisseur, we provide a key to the genera of males after the key to the genera of workers. It is diffi-

cult for even the most accomplished myrmecologist to identify males to the species level unless workers and queens were collected along with the males at the same time from the same nest. We make no attempt to describe the males of the different species, some of which have never even been seen!

Now back to the workers (or queens). Keeping the ant in profile, look closely at the pedicel—the structure that connects the mesosoma, with its three pairs of legs, to the gaster behind it. Does the pedicel have one or two distinct segments? Does the gaster end in a stinger (which rarely hurts more than being stuck by a tiny needle), a tiny nozzle (the acidopore) that can spray foul-smelling formic acid, or neither? These characters alone separate the New England subfamilies and subfamily groups: two-segmented petiole = Myrmicinae; one-segmented petiole + acidopore = Formicinae; one-segmented petiole + stinger = poneroids; one-segmented petiole with neither acidopore nor stinger = Dolichoderinae.

Next, look at the face. Are the compound eyes large or small? How about those jaws (count the teeth on the mandibles)? Check out the antennae—how many segments are there (be sure to include both the scape and all of the segments of the funiculus in your count)? Is the scape longer than the head, or is it shorter? Does the funiculus end in a swollen club or not? As you can see in either the key to the subfamilies and genera of workers or the corresponding key to the males, combinations of these characters separate most of the genera.

For those few genera that remain, go back to the profile of the body. The shape of the petiole (barrel-shaped, triangular, or with a pronounced, elongated peduncle toward the front) is a helpful character for separating out some of the smaller ants in closely related genera of the Myrmicinae.

Once you've determined the genus, head for the species pages. These are organized by subfamily. Ant species in three subfamilies, the Dolichoderinae, Formicinae, and Myrmicinae, and one subfamily group, the poneroids, occur in New England. The New England poneroids are represented by three closely related and only recently separated subfamilies, the Amblyoponinae, the Ponerinae, and the Proceratiinae. Many more poneroids can be found in the tropics and subtropics.

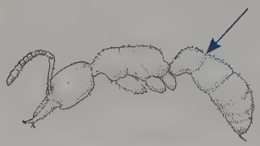
Within each subfamily section, the pages are organized alphabetically by genus and then alphabetically by species within a genus. For each genus, we first describe its name, history, distribution, diversity, and the characters used to distinguish among the New England species. Then we present one or two keys to the species. For genera with fewer than four species, there is an illustrated dichotomous key to the species. For genera with four or more species, we also include a full-color matrix key showing all the species in rows so that specimens can easily be compared with all of the New England species in that genus. We conclude the discussion of the genus with a brief summary of the species that can be confused with those in other genera.

Key to the Subfamilies and Genera, Based on the Workers (and Queens)

Key to the Subfamilies

1a. **Gaster with a visible constriction between the 1st and 2nd segments** .... (Poneroids) 2

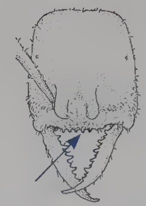
1b. **Gaster without a visible constriction** 4



Constriction between the first two gastral segments of the poneroids

2a (from 1a). **Teeth present and prominent on the lower (anterior) margin of the clypeus;** the attachment of the petiole to the gaster is broad.... Amblyoponinae (1 genus, 1 species—*Stigmatomma pallipes*), p. 89

2b. **No teeth on the anterior margin of the clypeus;** the attachment of the petiole to the gaster is narrow, resulting in distinct anterior, posterior, and dorsal surfaces of the petiole...3

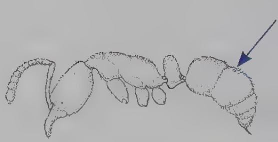


Teeth on the anterior margin of the clypeus of *Stigmatomma*

3a (2b). **The 2nd segment of the gaster is greatly enlarged and arched** so that it appears as the hindmost section of the gaster when the ant is viewed in profile; the remaining segments of the gaster curl underneath the 2nd segment and point toward the front of the ant.. Proceratiinae (1 genus—*Proceratium*, 3 species), p. 93

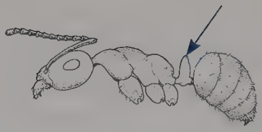
Enlarged second gastral segment of *Proceratium*

3b. **The 2nd segment of the gaster is not enlarged and not strongly arched;** the remaining segments of the gaster point away from the front of the ant.................... .... Ponerinae (3 genera, 1 species each) 6



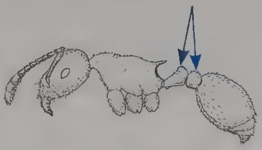
"Normal" second gastral segment of Ponerinae

4a (from 1b). **Postpetiole absent** (pedicel has only 1 segment) 5



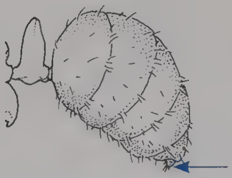
Single-segmented pedicel of Formicinae and Dolichoderinae

4b. **Postpetiole present** (pedicel has 2 segments)..................... .... Myrmicinae (17 genera, 63 species) 8



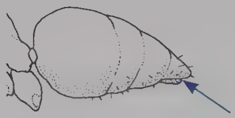
Two-segmented pedicel of Myrmicinae

5a (4a). **Acidopore (a small nozzle, often fringed with hair) present**....... Formicinae (8 genera, 66 species) 24



Acidopore at the end of the gaster of Formicidae

5b. **Acidopore absent**................. Dolichoderinae (2 genera, 7 species) 31



Horizontal slit at the end of the gaster of Dolichoderinae

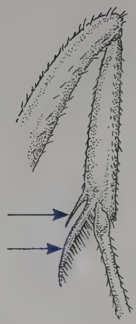
Key to the Genera

Numbering continues from the subfamilies.

6a (from 3b: Ponerinae). **A single tibial spur is visible on the hind tibia,** and the spur is comblike (pectinate), with many fine teeth 7

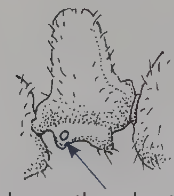
Single tibial spur of *Ponera* and *Hypoponera*

6b. **Two tibial spurs are visible on the hind tibia**—one is large and pectinate, the other is small, thin, and toothless; the appendage below the petiole (also called a subpetiolar process) is shaped like a parallelogram (a sideways rectangle); this ant is a non-native species of temperate forests. .... *Pachycondyla* (1 species—*P. chinensis*), p. 91



Two tibial spurs of *Pachycondyla*

7a (6a). **The subpetiolar process has a circular, usually translucent window near the front** and 2 small toothlike points projecting toward the back; this ant is a native species of forests.. *Ponera* (1 species—*P. pennsylvanica*), p. 92



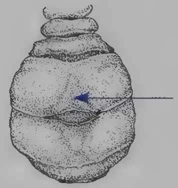
Window on the subpetiolar process of *Ponera*

7b. **The subpetiolar process does not have a translucent window**; the process itself is curved and lacks points; this ant is a non-native (tropical) species restricted in New England to the inside of heated buildings.............................. *Hypoponera* (1 species—*H. punctatissima*), p. 90

Windowless subpetiolar process of *Hypoponera*

8a (from 4b: Myrmicinae). **The gaster, viewed from above, has a prominent V-shaped depression running along almost its entire length**; this ant is a workerless, inquiline social parasite of *Tetramorium caespitum* .... *Anergates* (1 species—*A. atratulus*), p. 221

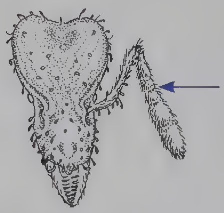
8b. **Gaster without a median longitudinal depression**............... 9



Medial depression on the gaster of *Anergates*

9a (8b). **Antennae with 6 segments**, the last 2 forming a distinct club............................*Pyramica* (3 species), p. 307

9b. **Antennae with more than 6 segments** 10

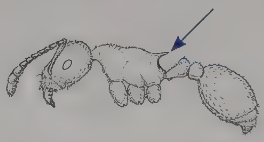


Six-segmented antenna of *Pyramica*

10a (9b). **Propodeum has neither long spines nor short, toothlike protuberances** 11

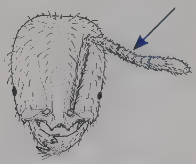
Absence of propodeal spines on *Monomorium* or *Solenopsis*

10b. **Propodeum armed with long spines or short, toothlike protuberances** 12



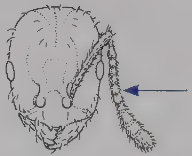
Propodeal spines on other Myrmicinae

11a (10a). **Antennae with 10 segments**, the last 2 forming a distinct club; these are tiny (body length < 2 mm), yellow or yellow-brown ants often found in or near colonies of larger ants .... *Solenopsis* (3 species), p. 312



10-segmented antenna of *Solenopsis*

11b. **Antennae with 12 segments**, the last 3 forming a distinct club; these ants are small (body length < 3 mm), shiny, black or yellow-red in color, and, if yellow-red, the gaster is black-tipped .... *Monomorium* (4 species), p. 253



12-segmented antenna of *Monomorium*

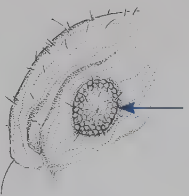
12a (10b). **The gaster is heart shaped; the petiole appears to be attached to the top (dorsal) surface of the gaster** ....*Crematogaster* (2 species), p. 236

12b. **The gaster is not heart shaped; the petiole appears to be attached to the front (anterior face) of the gaster** 13

Postpetiole that appears to attach dorsally to the gaster of *Crematogaster*

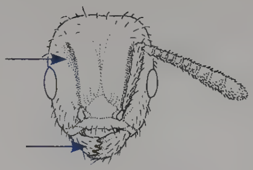
13a (12b). **The eyes have short, erect hairs between the facets (ommatidia) of the compound eyes** (visible at 25–50× magnification) ....*Formicoxenus* (1 species—*F. provancheri*), p. 240

13b. **Eyes without short, erect hairs between the ommatidia** 14



Hairy compound eyes of *Formicoxenus*

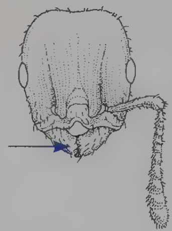
14a (13b). **Mandible with 4 or fewer teeth;** a long, raised edge (a carina) extends from the front posteriorly (toward the top of the head) beyond the eye and forms a groove (scrobe) in which the scape of the antenna can fit 15



Antennal scrobe and four-toothed mandibles of *Protomognathus*

14b. **Mandible with 5 or more teeth.** Front of the face without a scrobe 16

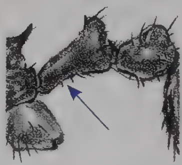
15a (14a). **Mandible with 4 teeth** .... *Protomognathus* (1 species—*P. americanus*), p. 305



15b. **Mandible with no teeth** ..... *Harpagoxenus* (1 species—*H. canadensis*), p. 242

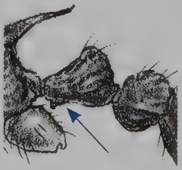
Toothless mandible of *Harpagoxenus*

16a (14b). **Petiole with a pronounced anterior peduncle** 17



A petiole with a peduncle

16b. **Petiole without a pronounced anterior peduncle** 22

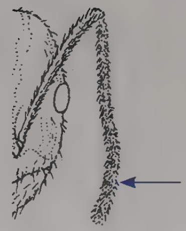


A petiole without a peduncle

17a (16a). **Antennal club with 3 segments** 18

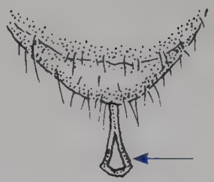
A three-segmented antennal club

17b. **Antennal club with 4 segments or indistinct** 21



An antenna without a club

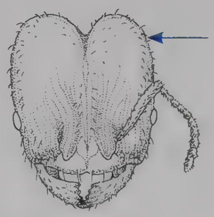
18a (17a). **Stinger ends in a small, triangular appendage** (visible at 25–50× magnification); top and side (posteriolateral) portions of clypeus raised into a thin, vertical ridge (carina) that forms a deep socket for the base of the antenna; mandibles with seven teeth; this ant is an exotic species commonly found nesting in driveways and on pavement .... *Tetramorium* (1 species—*T. caespitum*), p. 331



Triangular stinger of *Tetramorium*

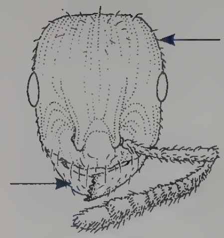
18b. **Stinger simple**; antennal socket not deep...................................... 19

19a (18b). **The workers are dimorphic (very large or very small); the large workers (majors) have disproportionately large heads with prominent posterior, muscle-filled lobes near the top of the head**; in both majors and small workers (minors), the propodeum is lower than (stepped down from) the level of the promesonotum; the propodeal spines are short and upturned; the sculpturing on the mesosoma is generally covered with small punctures (punctate)........ .... *Pheidole* (2 species), p. 301



Disproportionately large, lobed heads of *Pheidole* major workers

19b. **Workers not dimorphic, heads normal**; the sculpturing on the mesosoma is generally wrinkly, creased (rugose), or with small hexagonal pits (foveolate) 20

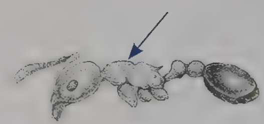


Proportionately sized heads of *Temnothorax*

20a (19b). **Erect hairs present on the mesosoma**; body sculpturing rugose or linear; workers are generally > 2.5 mm long...... ..... *Temnothorax* (5 species), p. 323

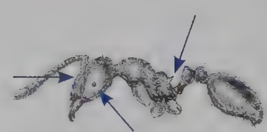
Erect hairs on the mesosoma of *Temnothorax*

20b. **Erect hairs absent on the mesosoma**; body sculpturing foveolate; workers generally < 1.5 mm long..... .. *Cardiocondyla* (1 species), p. 234



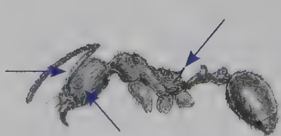
Absence of erect hairs on the mesosoma of *Cardiocondyla*

21a (17b). **The antennal scapes are short, not reaching the top of the head**; the eyes are small or vestigial; the propodeal spines are short; these are small ants (2.5–4.3 mm long)......... *Stenamma* (4 species), p. 315



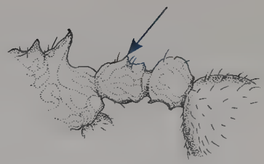
Short scapes, tiny eyes, and stubby spines of *Stenamma*

21b. **Antennal scapes extend beyond the top of the head**; eyes and propodeal spines both prominent; propodeum lower than (stepped down from) the level of the promesonotum; these are larger ants (4–6 mm long) ....*Aphaenogaster* (6 species), p. 223

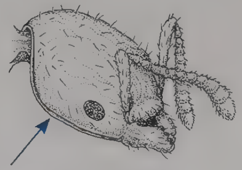


Long scapes, larger eyes, and longer spines of *Aphaenogaster*

22a (16b). **The petiole is short and cylindrical, appearing barrel shaped when viewed from the side;** the head has a prominent ridge that runs along the length of the head near the ventral margin; the propodeal spines are short and toothlike; 2 pairs of short propodeal spines usually are visible .... *Myrmecina* (2 species), p. 259



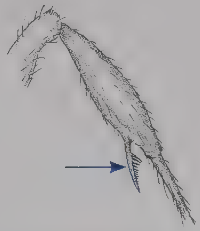
Barrel-shaped petiole of *Myrmecina*



Ridge on the side of the head of *Myrmecina*

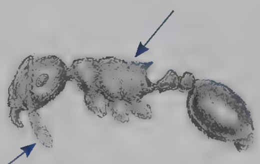
22b. **Petiole more triangular/conical than cylindrical when viewed from the side;** head without a prominent ridge running along the length of the head; propodeal spines are clearly developed; only 1 pair of propodeal spines 23

23a (22b). **Antennae with 12 segments; club may or may not be visible; tibial spines have fine teeth** (view at 50–100×); pronounced sculpturing and ridges (rugae) on the promesonotum and entire head; propodeal spines are pronounced and long .... *Myrmica* (21 species), p. 263



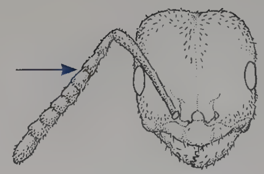
Pectinate tibial spur of *Myrmica*

23b. **Antennae with 11 segments and a 3-segmented antennal club; tibial spines lack fine teeth;** an impression or suture is usually visible on the metanotum. Propodeal spines are short or even stubby; mandibles have 6 teeth .... *Leptothorax* (5 species), p. 244



11-segmented antenna and suture on the metanotum of *Leptothorax*

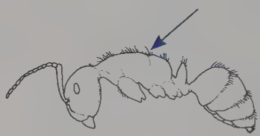
24a (from 5a: Formicinae). **Antennae with 9 segments;** this is a very small (workers ~ 1.5 mm long), yellow ant .... *Brachymyrmex* (1 species—*B. depilis*), p. 109



Nine-segmented antenna of *Brachymyrmex*

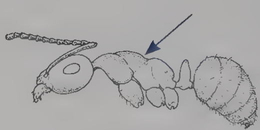
24b. **Antennae with 12 segments,** total body length variable 25

25a (24b). **Mesosoma smooth, with a convex profile;** antennal insertions set well back from the top (posterior border) of the clypeus; acidopore without fringing hairs .... *Camponotus* (9 species), p. 111



Smoothly convex profile of *Camponotus*

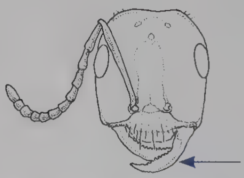
25b. **Mesosoma profile not smoothly convex—when viewed from the side, the propodeum is lower than (stepped down from) the level of the promesonotum;** antennal insertions are at, or adjacent to, the margin of the clypeus; acidopore with fringing hairs 26



Lumpy profile of other Formicinae

26a (25b). **Mandibles long, sickle shaped, and lacking large teeth** (but with serrated edges) .... *Polyergus* (3 species), p. 214

26b. **Mandibles with prominent teeth** 27

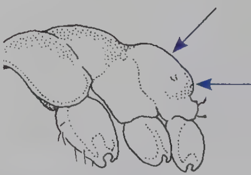


Sickle-shaped mandibles of *Polyergus*

27a (26b). **Mandibles with at least 7 teeth**................ 28

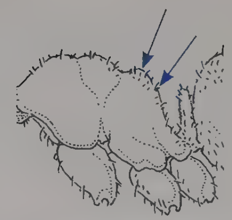
27b. **Mandibles with 5 or 6 teeth**.............................. 29

28a (27a). **The simple eyes (ocelli) are large and distinct;** the dorsal surface (top) of the propodeum is usually longer than its sloping posterior (rear) surface (the declivity), or the propodeum is evenly rounded without distinguishable surfaces; these are mostly larger ants (>4 mm), often seen on the ground foraging; the color is variable .... *Formica* (31 species), p. 127



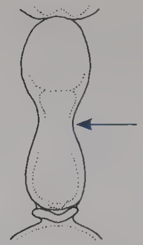
Top of the propodeum longer than its declivity in *Formica*

28b. **Ocelli small and indistinct or not visible;** dorsal surface of the propodeum apparent and notably shorter than its declivity; these small (<4 mm), mostly subterranean, ants are brown, orange, or yellow .... *Lasius* (17 species), p. 178



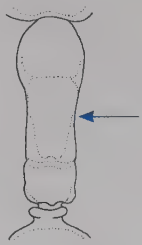
Top of the propodeum shorter than its declivity in *Lasius*

29a (27b). **The mesosoma viewed from above is strongly constricted behind the pronotum,** giving the mesosoma a distinctive hourglass appearance; the erect hairs on the mesonotum are short (0.1–0.15 mm long) and bristlelike; in full-face view, the eyes are situated above the midline of the head .... *Prenolepis* (1 species—*P. imparis*), p. 219



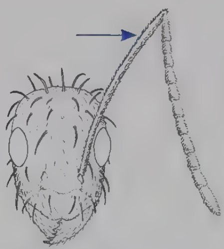
Hourglass-shaped mesosoma of *Prenolepis* (dorsal view)

29b. **Mesosoma viewed from above not sharply constricted behind the pronotum;** erect hairs on the mesonotum are long (>0.2 mm long) and coarse, not bristly; in full-face view, the eyes are situated at or slightly below the midline of the head 30



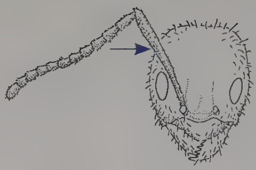
The unconstricted mesosoma of other Formicinae (dorsal view)

30a (29b). **Antennal scapes very long, at least 1.7× (and usually 2×) as long as the head;** no erect hairs on the scape or propodeum; erect hairs on the head scattered across the surface; mandibles with 5 teeth.......................... *Paratrechina* (1 species—*P. longicornis*), p. 212



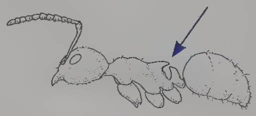
Very long antennal scape of *Paratrechina*

30b. **Antennal scapes shorter, less than 1.5× as long as the head;** hairs present or absent on the scape, absent on the propodeum; mandibles with 6 teeth .... *Nylanderia* (3 species), p. 206



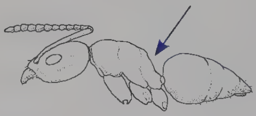
Shorter antennal scape of *Nylanderia*

31a (from 5b: Dolichoderinae). **The posterior surface of the propodeum viewed in profile is strongly concave, forming a shelf or "beer-bottle opener" that overhangs the petiole;** the petiole fits into this concavity .... *Dolichoderus* (4 species), p. 96



"Beer-bottle-opener"-shaped propodeum of *Dolichoderus*

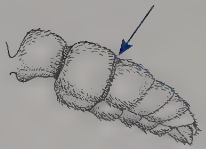
31b. **The posterior surface of the propodeum is relatively flat and smooth.** The petiole is flattened (vestigial) and may be hidden by the first segment of the gaster .... *Tapinoma* (3 species), p. 103



Flat propodeum of *Tapinoma*

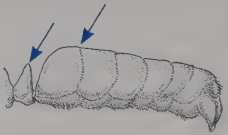
Key to the Subfamilies and Genera, Based on the Males

Key to the Subfamilies



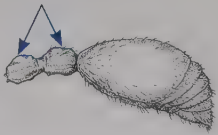
Constriction between the first two segments of the gaster of the poneroids

1a. **Gaster with a distinct constriction between the 1st and 2nd segments** .... Poneroids (5 genera) 3



One-segmented pedicel and unconstricted gaster of the Dolichoderinae and Formicinae

1b. **Gaster lacking a distinct constriction between the 1st and 2nd segments** 2



Two-segmented pedicel of the Myrmicinae

2a (1b). **Postpetiole absent** (pedicel with only 1 segment) .... Dolichoderinae (2 genera) + Formicinae (8 genera) 7

2b. **Postpetiole present** (pedicel with 2 segments) .... Myrmicinae (17 genera) 16

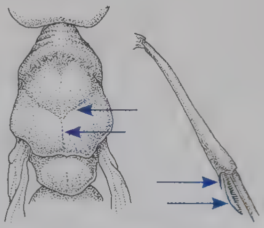
Key to the Genera

Numbering continues from the subfamilies.

Workerlike males with 12-segmented antennae of *Hypoponera*

3a (1a: Poneroids). **Males wingless, resembling workers ("ergatandrous")**; antennae with 12 segments ...... *Hypoponera*

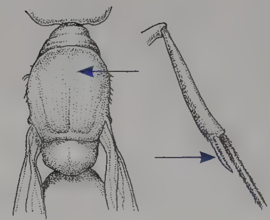
3b. **Males with wings, distinct from workers**; antennae with 13 segments 4



Mayrian furrows (left) and double-spurred hind tibia (right) of *Stigmatomma* and *Pachycondyla*

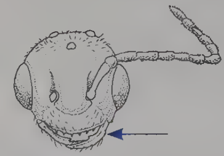
4a (3b). **Y-shaped sutures ("Mayrian furrows") visible on the top (dorsal) surface of the pronotum**; hind tibia with 2 spurs—1 large, 1 small...5

4b. **Mayrian furrows absent**; hind tibia with only a single small spur 6



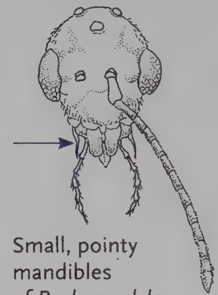
Absence of Mayrian furrows (left) and single-spurred hind tibia (right) of *Ponera* and *Proceratium*

5a (4a). **The mandibles are sickle shaped;** the anterior margin of the clypeus has small, bumplike teeth; the petiole is distinctly cube shaped, and its attachment to the gaster is large and broad; this is a dark brown to black ant .... *Stigmatomma*



Sickle-shaped mandibles of *Stigmatomma*

5b. **Mandibles short and pointed;** anterior margin of the clypeus lacks teeth; petiole distinctly triangular in profile, and its attachment to the gaster is small; this is a pale yellowish-white ant.................... *Pachycondyla*

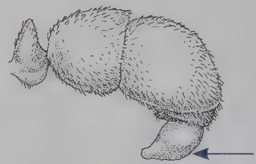


Small, pointy mandibles of *Pachycondyla*

6a (4b). **The very last segment of the gaster (the pygidium) has a distinct spine;** the antennal scape is much shorter than the first segment of the funiculus; the pair of appendages on the rear of the gaster (parameres) point rearward and are not noticeably enlarged.. *Ponera*

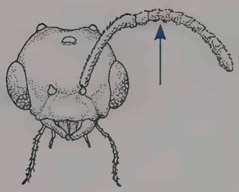
Spined pygidium of *Ponera*

6b. **Pygidium without a distinct spine;** antennal scape much longer than the first segment of the funiculus; parameres enlarged and tucked under the last segment of the gaster................................*Proceratium*



Enlarged parameres of *Proceratium*

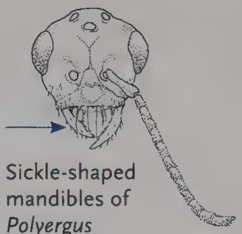
7a (2a: Dolichoderinae + Formicinae). **Antennae with 10 segments**..*Brachymyrmex*



Ten-segmented antenna of *Brachymyrmex*

7b. **Antennae with 13 segments**.. 8

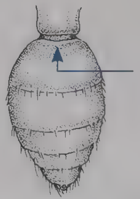
8a (7b). **Mandibles thin, curved, and sickle shaped** and without any teeth .... *Polyergus*



Sickle-shaped mandibles of *Polyergus*

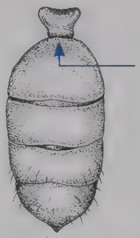
8b. **Mandibles robust, with at least 1 apical tooth** and often with many small teeth along their inner margin 9

9a (8b). **Viewed from above, the base of the gaster** (that is, the part just behind the petiole) **is distinctly concave** 10



Concave base of the gaster of *Nylanderia* (dorsal view)

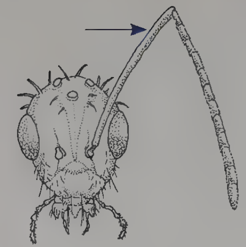
9b. **Viewed from above, the base of the gaster is even across its entire width or is convex**............................14



Convex base of the gaster of *Camponotus* (dorsal view)

10a (9a). **Antennal scape very long, at least 1.7× the length of the head;** no hairs on the scape .... *Paratrechina*

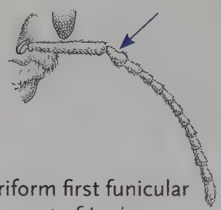
10b. **Antennal scape less than 1.5× the length of the head;** scapes with or without hairs 11



Very long scape of *Paratrechina*

11a (10b). **First segment of the funiculus triangular or pear shaped** (pyriform) .... *Lasius*

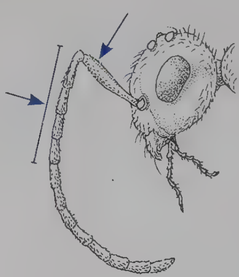
11b. **First segment of the funiculus not pyriform** 12



Pyriform first funicular segment of *Lasius*

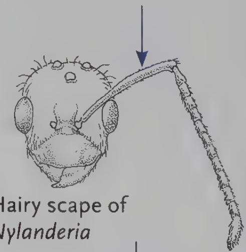
12a (11b). **Antennal scape shorter than the sum of the lengths of the first 4 funicular segments** .... *Prenolepis*

12b. **Antennal scape longer than the sum of the lengths of the first 4 funicular segments** 13



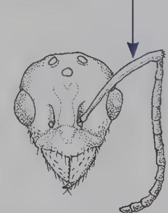
Short antennal scape of *Prenolepis*

13a (12b). **Tibiae and scapes with dark erect or nearly erect hairs** .... *Nylanderia*



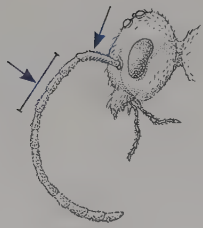
Hairy scape of *Nylanderia*

13b. **Tibiae and scapes without dark, erect hairs;** mandibles with many small teeth along their inner margin .... *Tapinoma*



Hairless scape of *Tapinoma*

14a (9b). **Antennal scapes shorter than the sum of the lengths of the first 3 funicular segments;** mandibles with many small teeth along their inner margin .... *Dolichoderus*



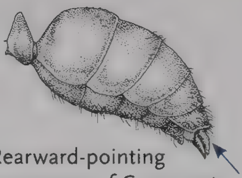
Very short scape of *Dolichoderus*

14b. **Antennal scapes at least as long as the sum of the lengths of the first 4 funicular segments;** mandibles with a pronounced apical tooth but few if any other teeth.. 15

15a (14b). **Genital appendages (parameres) large and pointed downward (ventrally),** making almost a right angle with the gaster; antennal scapes insert at, or just above, the clypeus and are not longer than the sum of the lengths of the first 5 funicular segments................ *Formica*

Downward-pointing parameres of *Formica*

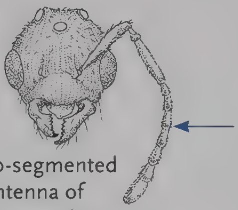
15b. **Parameres pointed rearward, in line with the gaster;** antennal scapes insert well above the clypeus, and they are as long as or longer than the sum of the lengths of the first 6 funicular segments.. *Camponotus*



Rearward-pointing parameres of *Camponotus*

16a (2b: Myrmicinae). **Antennae with 10 segments**...................... .... *Tetramorium*

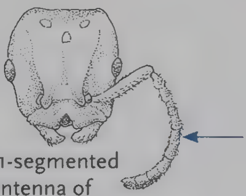
16b. **Antennae with more than 10 segments**............................. 17



10-segmented antenna of *Tetramorium*

17a (16b). **Antennae with 11 segments;** males are wingless and look like pupae; this ant is an inquiline social parasite of *Tetramorium caespitum* ....*Anergates*

17b. **Antennae with 12 or 13 segments**................................. 18

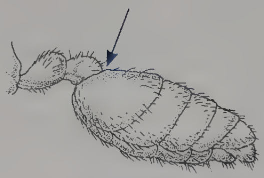


11-segmented antenna of *Anergates*

18a (17b). **Antennae with 12 segments**............................19

18b. **Antennae with 13 segments**....................................25

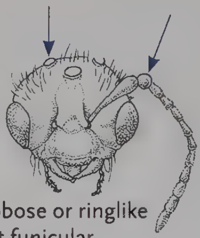
19a (18a). **Gaster is heart shaped;** the postpetiole appears to be attached to the top (dorsum) of the gaster... *Crematogaster*



Postpetiole that appears to attach dorsally to the gaster of *Crematogaster*

19b. **Gaster is not heart shaped;** the postpetiole is attached to front (anterior) of gaster.................. 20

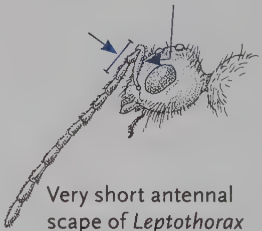
20a (19b). **First segment of funiculus ringlike or nearly spherical (globose);** Y-shaped grooves (Mayrian furrows) visible on top (dorsal surface) of the pronotum; simple eyes (ocelli) protrude noticeably from head .... *Solenopsis*



Globose or ringlike first funicular segment of *Solenopsis*

20b. **First segment of funiculus cylindrical;** Mayrian furrows absent; ocelli present but do not protrude from head.................................21

21a (20b). **Antennal scape not longer than the sum of the lengths of the first 2 segments of the funiculus;** antennal scrobe absent .... *Leptothorax*

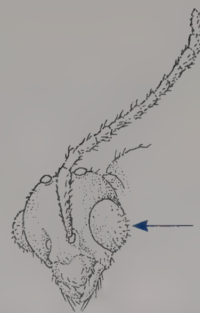


Very short antennal scape of *Leptothorax*

21b. **Antennal scape longer than the sum of the lengths of the first 2 segments of the funiculus;** antennal scrobe may be present or absent.. 22

22a (21b). **Compound eyes with short erect hairs between the ommatidia**.................. ....*Formicoxenus*

22b. **Compound eyes without short erect hairs between the ommatidia**.............23



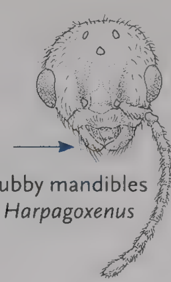
Hairy eyes of *Formicoxenus*

23a (22b). **Antennal scrobe absent**............ ....*Temnothorax*

23b. **Antennal scrobe present**................ 24

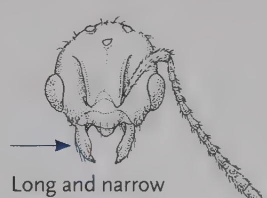
Absence of antennal scrobe on head of *Temnothorax*

24a (23b). **Mandibles stubby and squared off, lacking teeth**.............. ....*Harpagoxenus*



Stubby mandibles of *Harpagoxenus*

24b. **Mandibles long and narrow, with small teeth** and ending in a sharp point..........*Protomognathus*



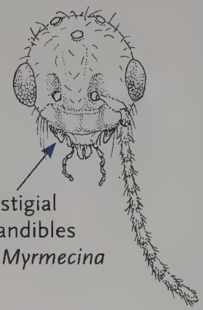
Long and narrow mandibles of *Protomognathus*

25a (18b). Males wingless and workerlike (ergatandrous) in appearance........................ *Cardiocondyla* (wingless males)

25b. Males winged and not workerlike in appearance 26

26a (25b). **Mandibles absent or present only as short, toothless stubs**; petiole cylindrical and barrel shaped when viewed from the side .... *Myrmecina*

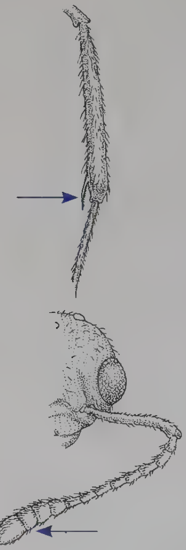
26b. **Mandibles present**; petiole triangular, with or without a pronounced peduncle.................. 27



Vestigial mandibles of *Myrmecina*

27a (26b). **Tibial spurs on middle and hind legs with distinct teeth**; antennae with a distinct 4- or 5-segmented club ....*Myrmica*

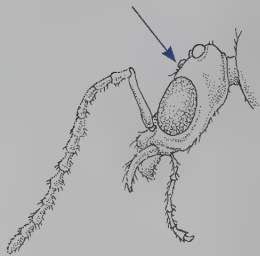
27b. **Tibial spurs lacking distinct teeth**; antennae without a distinct club............. 28



Pectinate tibial spur (top) and clubbed antenna (bottom) of *Myrmica*

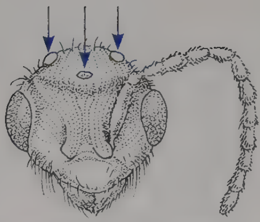
28a (27b). **Head viewed in profile distinctly flattened**; eye as tall as the head.............. ....*Aphaenogaster*

28b. **Head viewed in profile not distinctly flattened**; eye not as tall as the head 29



Flattened head of *Aphaenogaster*

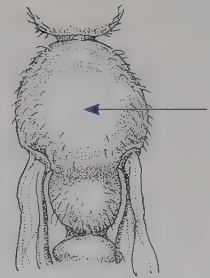
29a (28b). **Ocelli raised from the head on a pronounced platform**; petiole without a pronounced peduncle .... *Pheidole*



Raised ocelli of *Pheidole*

29b. **Ocelli present but not raised on a platform**; petiole with a pronounced peduncle 30

30a (29b). **Mayrian furrows absent**; head not longer than broad 31



Absence of Mayrian furrows on mesosoma of *Monomorium* or *Cardiocondyla*

30b. **Mayrian furrows present**; if Mayrian furrows are indistinct, the head is distinctly longer than broad 32

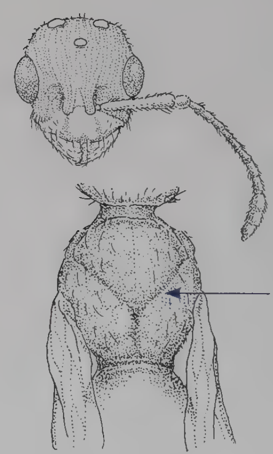
31a (30a). **Antennal scape approximately as long as the sum of the lengths of the first 2 antennal segments** .... *Monomorium*

31b. **Antennal scape at least as long as the sum of the lengths of the first 5 antennal segments** ... . *Cardiocondyla* (winged males)

32a (30b). **Head distinctly longer than broad**; petiole and postpetiole with thin, membranous appendages, especially on their lower surfaces; Mayrian furrows may be indistinct.........
.... *Pyramica*

Long head (top) and membraneous appendages (bottom) under petiole of *Pyramica*

32b. **Head not longer than broad;** petiole and postpetiole lacking thin, membranous appendages; Mayrian furrows pronounced .... *Stenamma*



Round head (top) and pronounced Mayrian furrows (bottom) of *Stenamma*

Poneroids

The Wretched, Laboring Ants

From the Greek *ponerá*, meaning wretched, oppressed, injurious, or evil, which itself is derived from *pónos*, meaning work or labor

The seven species of poneroids in New England are cryptic (hard to find), mostly litter-dwelling ants. Systematists not only separate the poneroids into multiple genera but also separate them into five subfamilies, three of which—the Amblyoponinae, Ponerinae, and Proceratiinae—are represented in New England. However, we discuss the poneroids together because they share two easy-to-recognize features: (1) a constriction between the first two segments of the gaster that gives these ants a wasp waist and (2) a prominent, wasplike stinger. The resemblance of poneroids to small wasps is not coincidental. The poneroid families group together at the base of the ant family tree (see Figure 2.5), which itself is an offshoot of the vespid wasps (a group that includes the familiar bald-faced hornets and yellow jackets). Despite their long evolutionary history, poneroid species make small colonies and, compared with other ant species, are the least eusocial; this "poneroid paradox" is an active area of myrmecological research.

Poneroids are mainly tropical and subtropical ants; of the 34 North American species, only 5 are native to temperate New England. The Asian "immigr-ant," *Pachycondyla chinensis*, is rapidly approaching New England from the south. Our one additional species, *Hypoponera punctatissima*, is a subtropical tramp that can live in New England only in heated buildings. It most commonly lurks in hospital basements and commercial kitchens and usually is observed only when queens emerge from hidden nooks and crannies to establish new colonies.

Identifying the Poneroid Species

It is straightforward to separate the three subfamilies and four genera of poneroids using the genus-level key at the beginning of this chapter. The large, scraggly teeth on the mandibles and another row of teeth on the lower (anterior) edge of the clypeus distinguish *Stigmatomma* from the other three genera. The profile of *Proceratium*, with its enlarged and arched gaster, distinguishes it from the more typical-looking *Ponera* and *Hypoponera*. Finally, because *Hypoponera* cannot tolerate New England winters, you can distinguish it from *Ponera* and *Pachycondyla* simply by noting whether you collected it out of doors. *Pachycondyla* is separated from *Ponera* by the number of tibial spurs: two in *Pachycondyla*, one in *Ponera*.

Because four of the five genera have only one species each in New England, identifying the genus also gets you the species with no extra effort! If it's *Stigmatomma,* it's *S. pallipes.* If it's *Hypoponera,* it's *H. punctatissima.* If it's *Pachycondyla,* it's *P. chinensis.* And if it's *Ponera,* it's *P. pennsylvanica.*

Distinguishing the three species of *Proceratium* takes a bit more work and is best done by examining pinned specimens under a dissecting microscope. All three *Proceratium* species have a distinctive gaster: the second segment of the gaster is greatly enlarged, and the remaining segments are tucked underneath it; as a consequence, the stinger points forward. *Proceratium pergandei* is the easiest of the three *Proceratium* species to distinguish; look carefully at the position of the tucked-under segments of the gaster. In *P. pergandei,* these segments appear to hang off the middle of the second segment of the gaster, whereas in the other two species these segments are suspended from the back of the second segment of the gaster. Furthermore, the clypeus of *P. pergandei* has a lobe projecting from the middle, whereas in the other two species the clypeus has no lobe. The profile of the petiole separates *P. crassicorne* from *P. silaceum.* The petiole of *P. crassicorne* is thick and nearly rectangular in profile—the top of the petiole is nearly as thick as the base. In contrast, the petiole of *P. silaceum* is tapered—the top of the petiole is much thinner than the base. *Proceratium crassicorne* also has short, sparse hairs on its gaster, whereas *P. silaceum* has long, dense hairs on its gaster. These are subtle characters; taxonomists didn't even distinguish these as two separate species until 2003.

The matrix key on p. 85 illustrates three morphological characters that can be used to quickly separate the seven New England poneroids. Each species is shown in profile; the size shown is approximately five times the size of an average worker. The primary characteristics to look for on the face are large, scraggly-toothed mandibles and a toothed clypeus (*Stigmatomma pallipes*), finer-toothed mandibles (*Ponera pennsylvanica, Hypoponera punctatissima,* and *Pachycondyla chinensis*), or coarse-toothed mandibles and small, close-set frontal lobes (*Proceratium* species). The enlarged second segment of the gaster with the remaining segments tucked under the gaster also distinguishes *Proceratium* from the other three genera. The shape of the petiole can be used to reliably separate all seven species. In *S. pallipes,* the petiole is cylindrical and has no apparent scale. The three Ponerinae (*Ponera pennsylvanica, Hypoponera punctatissima,* and *Pachycondyla chinensis*) have large petioles, but the hardened lobe of tissue suspended beneath the petiole (a subpetiolar process) differs in shape among these three genera. In *Ponera,* the subpetiolar process has a small translucent, circular "window" near its front and a sharp tooth toward its back. Neither the window nor the tooth is present in the other two species. The subpetiolar process is rounded in *Hypoponera* and trapezoidal in *Pachycondyla.* Finally, *Proceratium pergandei* has a low, cylindrical petiole, whereas *Proceratium crassicorne* and

Stigmatomma pallipes

Pachycondyla chinensis

Hypoponera punctatissima

Ponera pennsylvanica

Proceratium pergandei

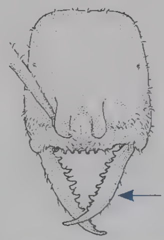
Proceratium crassicorne

Proceratium silaceum

Proceratium silaceum have taller petioles. The petiole of *P. crassicorne* is nearly as thick at the top as it is at the bottom and appears rectangular in profile. In contrast, the petiole of *P. silaceum* is much narrower at the top than it is at the bottom, and it appears triangular in profile. The species are ordered by size and genus—one species each in *Stigmatomma*, *Hypoponera*, and *Ponera* and three species in *Proceratium*.

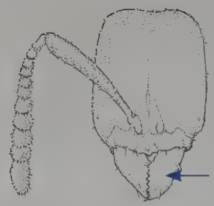
Key to the Poneroid Species

1a. **Mandible with both large and small teeth** and the margin of clypeus also with teeth; petiole broadly attached to the first segment of the gaster. . . . . *Stigmatomma pallipes*, p. 89



Distinctive mandibles of *Stigmatomma*

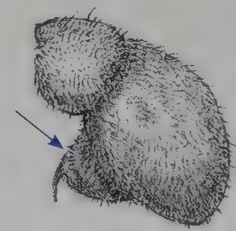
1b. **Mandible with teeth of only 1 size;** petiole narrowly attached to first segment of gaster 2



Fine teeth of other poneroids

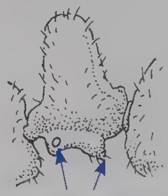
2a (1b). **End of gaster** and stinger **directed away from the front of the ant;** distinct impressions (sutures) are present on the pronotum and (usually) on the mesonotum; the antennal sockets are not exposed 3

2b. **End of gaster** and stinger **directed upward or toward the front of the ant;** no sutures are present on the pronotum and are rarely present on the mesonotum; the antennal sockets are exposed........................ (genus *Proceratium*) 5



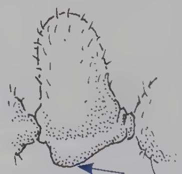
End of the gaster directed toward the front of the ant in *Proceratium*

3a (2a). **Subpetiolar process with a round** (or oval) **translucent "window"** (best viewed with transmitted light) near its front and a sharp tooth toward the back of the process................................*Ponera pennsylvanica,* p. 92



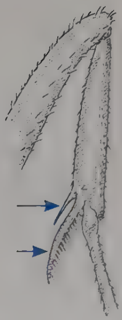
Windowed and toothed subpetiolar process in *Ponera*

3b. **Subpetiolar process lacking a translucent window** and lacking a tooth.. 4



Windowless subpetiolar process in *Hypoponera* and *Pachycondyla*

4a (3b). **Hind tibia with 2 spurs**—1 large and comblike with fine teeth (pectinate), 1 small and lacking teeth; workers are ≥ 4 mm long; this is an Asian species found in wooded habitats .... *Pachycondyla chinensis*, p. 91

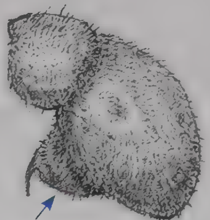


Two tibial spurs in *Pachycondyla*

4b. **Hind tibia with only 1 spur**, and it is pectinate; workers are ≤ 3 mm long; this is a subtropical species found only indoors in New England, most commonly seen as winged queens (alates) .... *Hypoponera punctatissima*, p. 90

One tibial spur in *Hypoponera* (and *Ponera*)

5a (2b). **2nd gastral segment enlarged; subsequent segments located below and near the front of the 2nd segment**; anterior border of the clypeus slightly convex with a projecting median lobe; petiole low and rounded when viewed from above .... *Proceratium pergandei*, p. 94



Gastral segments 3–7 located anteriorly in *Proceratium pergandei*

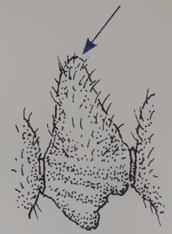
5b. **3rd and later gastral segments located below but near the back of the 2nd segment**; anterior border of clypeus without a median lobe; petiole relatively high and rectangular when viewed from above 6

Gastral segments 3–7 located posteriorly in *Proceratium crassicorne* and *P. silaceum*

6a (5b). **Petiole thick in profile (the crest is almost as thick as the base)**; frontal area one-fourth as wide as head; frontal carinae diverge toward the top of the head; erect hairs on gaster short and sparse ....*Proceratium crassicorne*, p. 93

Thick petiole of *Proceratium crassicorne*

6b. **Petiole slender in profile (crest distinctly thinner than base)**; frontal area > one-fourth as wide as head; frontal carinae strongly divergent toward the bottom of the head; erect hairs on gaster long and dense..................... *Proceratium silaceum*, p. 95



Tapered petiole of *Proceratium silaceum*

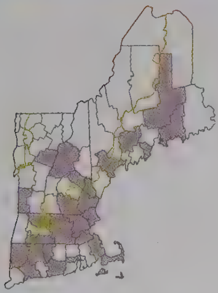
Easily Confused Species

The small, litter-dwelling poneroids are unlikely to be confused with other ant genera in our region.

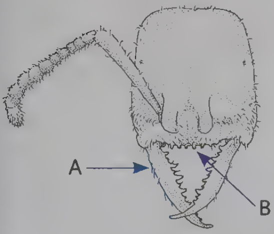
Stigmatomma pallipes (Haldeman, 1844)

The Vampire Ant

Refers to its eyes and legs: *stigma* (Gk: spot, mark); *omma* (Gk: eye) + *pallidus* (Lat: pale) + *pes* (Lat: foot).



Habitat: Entirely subterranean; makes small colonies (<60 workers) and nests under stones and in soil, litter, and rotten wood. Collect it in the iconic stone walls meandering through New England's forests.
Geographic range: The United States and Canada, except for the Pacific Coast, boreal Canada, and the northern Rocky Mountains.
Natural history: This predatory ant eats mostly centipedes and, in New England, small caterpillars and beetle larvae.
Look-alikes: None. This is the only New England Amblyoponinae species. The toothed clypeus and scraggly mandibular teeth are distinctive, suggesting its common name.

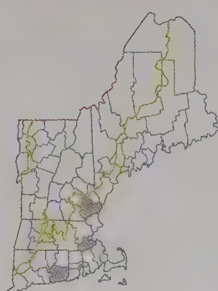


Distinguishing features:
A. Mandibles with both large and small teeth (cf. *Ponera pennsylvanica*)
B. Clypeal margin with prominent teeth
C. Large cube-shaped petiole broadly attached to the gaster

Hypoponera punctatissima (Roger, 1859)

The Very Punctate Poneroid

Refers to its head and body: *hypo-* (Gk: lesser) + *ponera* (Gk: worker); *punctatus* (Lat: embossed with punctures + *-issimus* (Lat: very).



Habitat: In its native, tropical range, nests in soil and damp litter. In New England, nests in the floors of large institutional kitchens and hospital laboratories.

Geographic range: Worldwide. This rapidly dispersing, warm-climate tramp species was originally described from a colony from Germany.

Natural history: This tropical species cannot tolerate New England winters; in our region it is found only in heated buildings. Occasional infestations in hospitals and commercial kitchens are discovered only when queens emerge en masse to disperse. Males lack wings and mate with their sisters in the nests.

Look-alikes: *Ponera, Pachycondyla;* subpetiolar lobe distinguishes them. In New England, *Hypoponera* is never found outside.

Distinguishing features:

A. Subpetiolar lobe without translucent window (cf. *Ponera pennsylvanica*)

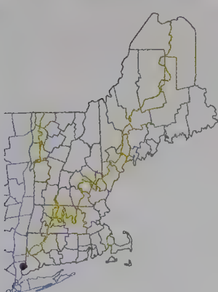
B. Subpetiolar lobe rounded and not toothed (cf. *Ponera pennsylvanica*)

C. Hind tibia with one spur

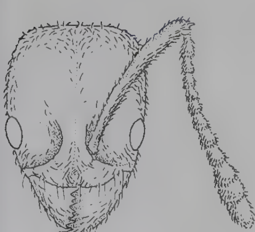
Pachycondyla chinensis Emery, 1895

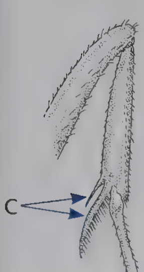
*The Asian Needle Ant

Refers to its antenna and type locality: *pachys* (Gk: thick) + *kondylos* (Gk: articulated joint) + *chinensis* (Lat: China).



Habitat: Forests, urban environments, and buildings. Nests in damp soil under rocks, rotten logs, railroad ties, bricks, pavement.
Geographic range: North and South Korea, Japan south of Hokkaido, Taiwan. First recorded in the United States in the 1930s; since then from Alabama, Florida, Georgia, North and South Carolina, Tennessee, Virginia, New York. Closest collection to New England is from Lewisboro, New York (1980), bordering Fairfield, Connecticut.
Natural history: Not aggressive, but stings when disturbed; ~ 1% of people stung have strong allergic reactions, including anaphylactic shock. Since the early 2000s, *P. chinensis* has been found in dense populations in North and South Carolina, where it is outcompeting native ant species.
Look-alikes: *Hypoponera, Ponera;* size, subpetiolar lobe, tibial spurs distinguish them.





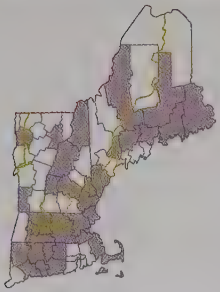
Distinguishing features:

A. Subpetiolar lobe without translucent window (cf. *Ponera pennsylvanica*)
B. Subpetiolar lobe trapezoidal (cf. *Hypoponera punctatissima*)
C. Hind tibia with two spurs

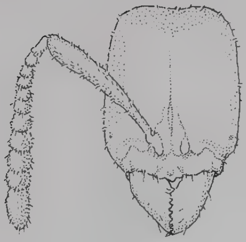
Ponera pennsylvanica Buckley, 1866

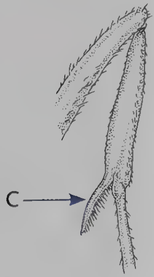
The Pennsylvania Ponera

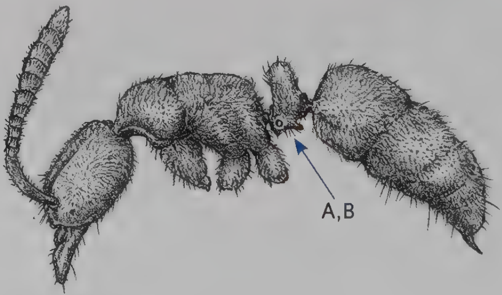
Refers to its type locality: *ponera* (Gk: worker); *Penn* (Eur. colonist William Penn) + *sylva* (Lat: forest), thus Pennsylvania.



Habitat: Nests anywhere there is enough moisture: under rotting logs; in rotten stumps; in leaf litter, soil, and other damp places in forests; in wet, grassy swales; in soggy fields; in bogs or fens.
Geographic range: Southern Canada south to the Gulf of Mexico; west to the Mississippi River.
Natural history: This is the most common poneroid in New England. Its colonies are small (<100 workers) and may be polygynous. It preys on small soil-dwelling arthropods.
Look-alikes: *Hypoponera, Pachycondyla;* the subpetiolar processes distinguish them. *Ponera* is the only one of these three genera native to New England; *Hypoponera* is found only indoors, and *Pachycondyla* has not yet been seen in New England. So if you collected the ant outside, it's most likely *Ponera*. But keep an eye out for *Pachycondyla,* which has been found just west of the Connecticut border.







Distinguishing features:

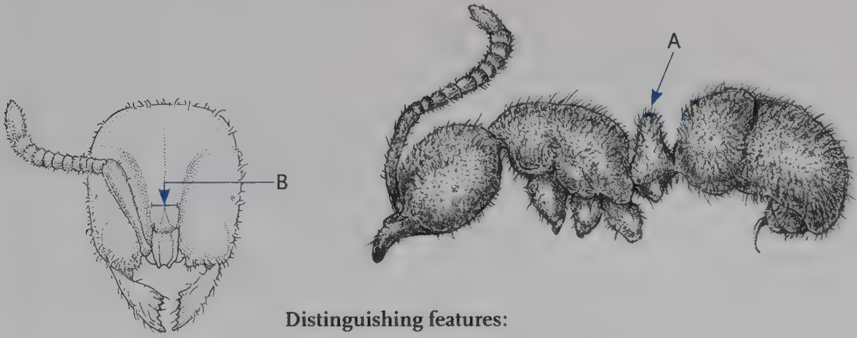
A. Subpetiolar lobe with a translucent window (cf. *Hypoponera punctatissima, Pachycondyla chinensis*)
B. Subpetiolar lobe ± square and toothed (cf. *Hypoponera punctatissima*)
C. Hind tibia with 1 spur (cf. *Pachycondyla chinensis*)

Proceratium crassicorne Emery, 1895

The Fat *Proceratium*

Refers to its head and thick petiole: *pró* + *cerátium* (Gk: forward-pointing little horn); *crassiore* (Lat: fat and thick).

Habitat: Subterranean; nests in soil or well-decayed rotten logs and stumps in open oak or oak-hickory woodlands and forests.
Geographic range: Massachusetts and New York south to Mississippi; west to Missouri.
Natural history: Little is known of this species, as it was separated from *Proceratium silaceum* only in 2003. It may prey on spider eggs. Its colonies are small (<100 workers) and may be polygynous.
Look-alikes: *Proceratium silaceum;* petiole shape and frontal width distinguish them.

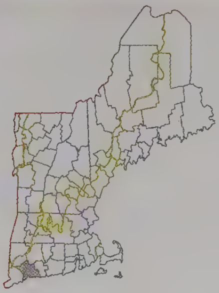


Distinguishing features:
A. Broad, thick petiole (cf. *P. silaceum*)
B. Relatively narrow front (cf. *P. silaceum*)

Proceratium pergandei (Emery, 1895)

Pergande's *Proceratium*

Refers to its collector, American entomologist Theodore Pergande (1840–1916).

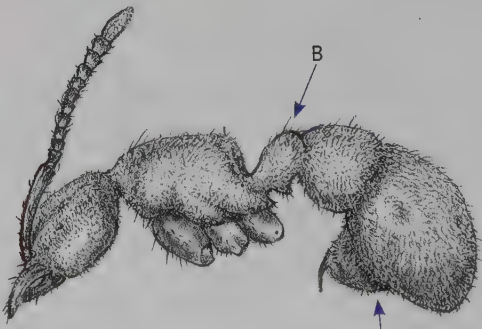


Habitat: Nests in well-decayed, rotten logs and stumps, under rocks, and in the soil in open oak or oak-hickory woodlands.

Geographic range: Massachusetts south to Florida; west to Iowa, Arkansas, Louisiana. Only one New England record, from West Rock Park near New Haven, Connecticut.

Natural history: This species is thought to be a specialized predator that feeds on spider eggs.

Look-alikes: *Proceratium crassicorne, P. silaceum:* petiole shape and position of terminal gastral segments distinguish them.



Distinguishing features:

A. Terminal gastral segments tucked under second segment and located far forward

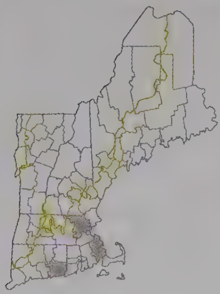
B. Bun-shaped petiole

C. Projecting lobe in center of anterior clypeal margin

Proceratium silaceum Roger, 1863

The Yellow *Proceratium*

Refers to its color: *silaceum* (Lat: yellow ochre).

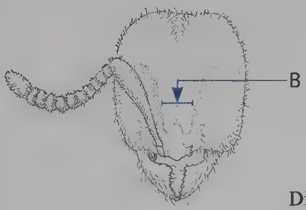


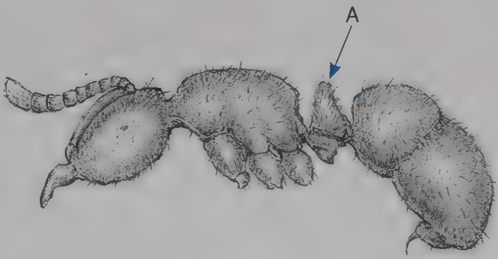
Habitat: Nests underground in soil or in well-decayed rotten logs or stumps in open oak or oak-hickory woodlands and forests.

Geographic range: Massachusetts south to Florida; west to Illinois, Arkansas, Oklahoma. A disjunct record from Pelee Island, Ontario (Canada).

Natural history: May prey on eggs of ants, spiders, and other arthropods. Colonies are small (<100 workers) and may be polygynous.

Look-alikes: *Proceratium crassicorne;* petiole shape and frontal width distinguish them.





Distinguishing features:

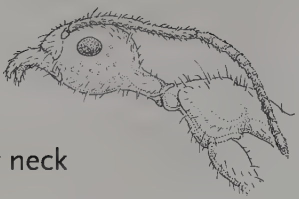
A. Tapering petiole (cf. *P. crassicorne*)

B. Relatively wide front (cf. *P. crassicorne*)

Dolichoderus Lund, 1831

The Long-necked Ants

From the Greek *dolichós*, meaning long,
in the sense of extended, + *der*(*o*), meaning neck



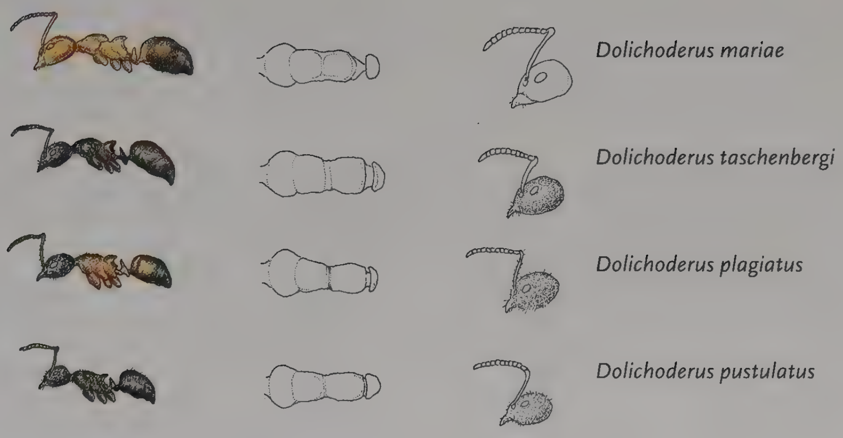
Dolichoderus is the largest genus of ants in the subfamily Dolichoderinae; nearly 200 species have been described across Europe, Southeast Asia, Australia, and North, Central, and South America. There are only four North American species of *Dolichoderus*, all of which were formerly placed in the genus *Hypoclinea* and all of which can be found in New England. None of them have the long neck (actually the rear portion of the head that narrows posteriorly) of the type species *Dolichoderus attelaboides* (Fabricius, 1775), shown above. Still, the New England *Dolichoderus* is one of the easiest genera to recognize. The rear (posterior) face (the declivity) of the propodeum in our species is concave, giving ants in this genus a distinctive profile that looks like a bottle opener.

Identifying the Species of *Dolichoderus*

Dolichoderus

The four New England species of *Dolichoderus* are well defined and easy to identify. Start by looking down at the back of the ant. The top of the bottle-opener-shaped propodeum is nearly square in *D. taschenbergi* and *D. mariae* but is clearly rectangular in the other two species. *Dolichoderus taschenbergi* is black and hairy, but *D. mariae* is bicolored (head and mesosoma red, gaster black) and lacks erect hairs on the antennal scapes and the top of the mesosoma. Of the two species with a rectangular propodeum, *D. plagiatus* has many (at least 10) erect hairs on the antennal scapes, whereas *D. pustulatus* has sparse erect hairs on the antennal scapes (usually 4 or fewer) and on the back of the mesosoma. The color of these two species varies from all black to bicolored with a mix of red and black.

Observations of colony structure in the field can also help distinguish these species. *Dolichoderus pustulatus* and *D. plagiatus* make small colonies (normally fewer than 200 workers) in ephemeral nest sites and usually have only single queens. We commonly find carton nests of *D. pustulatus* in old leaves of the northern pitcher plant, *Sarracenia purpurea*, in bogs and other open wetlands. *Dolichoderus plagiatus* tends to avoid wetlands in favor of drier, but still open, habitats. In contrast, the other two species, *D. mariae* and *D. taschenbergi*, make large colonies (often > 10,000 ants); their nests are igloo-shaped dome nests ranging in size from 5 to 50 cm in height that are made out of grasses, *Sphagnum* mosses, pine or spruce needles, and other shredded vegetation. These two species may have multiple queens, are very aggressive, and often forage on well-defined scent trails.



This matrix key illustrates three morphological characters that can be used to quickly determine which species of *Dolichoderus* you have. Each species is shown in profile; the size shown is approximately four times the size of a worker, and the colors illustrate both shades and bicoloration. The species are ordered by size, but note that the differences in length among species average less than 1 mm. The primary characteristic to look for on the mesosoma is the relationship between the length and the width of the propodeum (viewed dorsally, looking down on the ant). The length and width of the propodeum are approximately equal in *D. taschenbergi* and *D. mariae* and unequal in the other two species. Head profiles illustrate the prominence of pitting and sculpturing and the relative hairiness of the head and antennal scapes. *Dolichoderus mariae* has no hairs and little sculpturing, *D. pustulatus* has few hairs and more sculpturing, and *D. plagiatus* has many hairs and the most sculpturing.

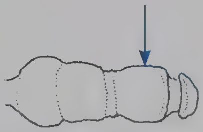
Key to the Species of *Dolichoderus*

1a. **No hairs on the antennal scape or mesosoma and few if any hairs (<5) on the first segment of the gaster;** this is a bicolored ant whose head and mesosoma are red and whose gaster is black .... *D. mariae*, p. 99

Nearly hairless gaster of *D. mariae*

1b. **Antennal scape, mesosoma, and gaster with at least 5 erect hairs, usually many more;** body color variable 2

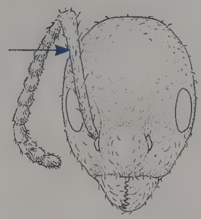
2a (1b). **In dorsal view, the propodeum is nearly square** (subquadrate: equal in length and width or only slightly longer than it is wide); the ant is all black .... *D. taschenbergi*, p. 102



Nearly square propodeum of *D. taschembergi*

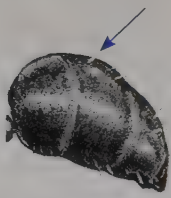
2b. **In dorsal view, the propodeum is substantially longer than it is wide;** color varies from all black to black with some red or orange 3

3a (2b). **The antennal scape has at least 10 erect hairs;** the sculpturing on the head and sides of the propodeum is coarse.. *D. plagiatus*, p. 100



Many erect hairs on scapes of *D. plagiatus*

3b. **Few (<10) hairs on the antennal scape, but hairs are more common on the dorsal surface of the mesosoma and gaster;** fine sculpturing on head and sides of propodeum, relatively shiny; in New England, this ant is generally black in color, but it can be bicolored in the southern United States....... *D. pustulatus*, p. 101



Hairy gaster of *D. pustulatus*

Dolichoderus

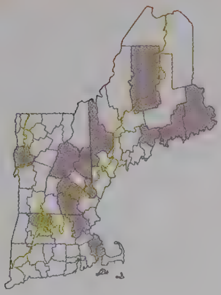
Easily Confused Species

In the field, unless you look closely with a high-powered hand lens (at least 10×), you may confuse *Dolichoderus* with similarly sized *Myrmica* species. This confusion arises because the concave C-shaped declivity of the propodeum may appear on first glance to be propodeal spines. A more powerful hand lens or a low-power dissecting microscope will clearly distinguish these genera.

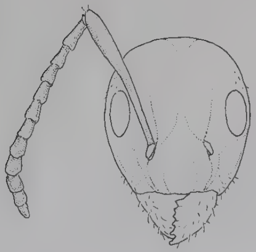
Dolichoderus mariae Forel, 1885

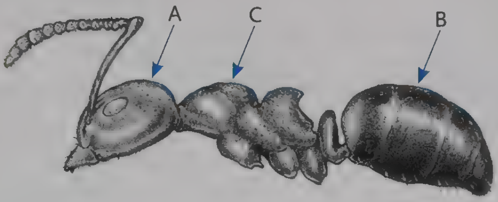
Mary's *Dolichoderus*

Refers to its collector, Mary Lua Adelia Davis Treat (1830–1923), an entomologist, botanist, and ornithologist.



Habitat: Nests in bogs, pine barrens, open dry sites.
Geographic range: New Brunswick south to Florida and the Gulf Coast; west into southern Quebec, Illinois, Minnesota, Oklahoma.
Natural history: Colonies are enormous (>10,000 workers); builds nests made of small domes of *Sphagnum* (in bogs) or of plant debris piled up around clumps of grass (in pine barrens and other dry, open sites). Colonies are frequently moved and nests often rebuilt, but scent-marked foraging trails are maintained and reused to find and tend aphids feeding on trees, shrubs, and herbs.
Look-alikes: Other North American *Dolichoderus*, especially *D. pustulatus;* size and pilosity distinguish them.



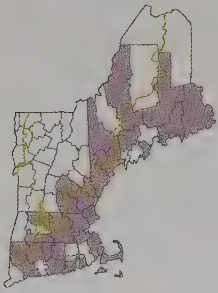


Distinguishing features:
A. No erect hairs on head, scapes, dorsum (cf. *D. taschenbergi*)
B. Bicolored: head and mesosoma red-orange; gaster dark
C. Smooth and shiny, with little sculpturing

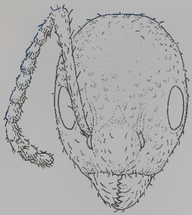
Dolichoderus plagiatus (Mayr, 1870)

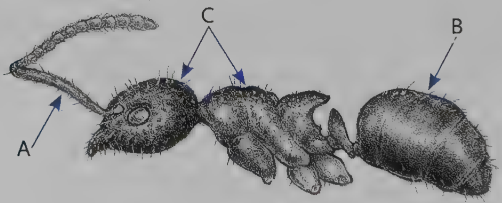
The Mottled *Dolichoderus*

Refers to its color: *plaga* (Lat: striped, streaked, mottled).



Habitat: Open fields, higher (drier) portions of bogs, drier areas of other herb-dominated wetlands.
Geographic range: New Brunswick south to South Carolina; west to the Dakotas, Quebec, Ontario, Manitoba.
Natural history: Colonies are usually small (<100 workers), monogynous, and hidden in clumps of grass, hollow stems of milkweed (*Asclepias* species) or dogbane (*Apocynum* species), dried and curled leaves, or hollowed-out twigs. Workers forage alone, preying on small invertebrates, scavenging debris, and tending aphids and scale insects. Entomologist Diethe Ortius recorded an intriguing observation of a *D. taschenbergi* queen living in a *D. plagiatus* nest, suggesting that *D. plagiatus* is a host for (temporarily) parasitic *D. taschenbergi*.
Look-alikes: *Dolichoderus pustulatus:* hairs on the scape distinguish them.





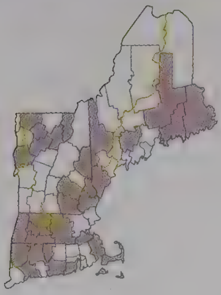
Distinguishing features:

A. Many erect hairs on scapes (cf. *D. pustulatus*)
B. Bicolored: head and gaster dark, mesosoma orange-brown
C. Head and mesosoma dorsum heavily sculptured

Dolichoderus pustulatus Mayr, 1886

The Common Bog *Dolichoderus*

Refers to its sculptured mesonotum: *pustule* (Lat: blister[ed]).

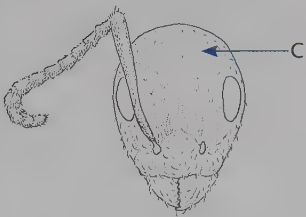


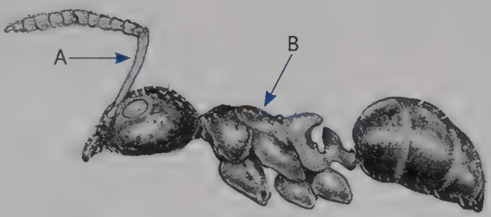
Habitat: Nests in old fields, wet meadows, bogs, fens, and other herb-dominated wetlands, in wetter areas than where *D. plagiatus* nests.

Geographic range: Nova Scotia south into Florida, Mississippi, Louisiana; west into southern Quebec, Minnesota, Illinois, Indiana.

Natural history: Colonies are small (<100 workers) and monogynous. In bogs, often makes carton nests in old pitchers of the carnivorous Northern Pitcher Plant, *Sarracenia purpurea*.

Look-alikes: *Dolichoderus mariae, D. plagiatus;* hairs on the scapes distinguish them. Color differences are unreliable.





Distinguishing features:

A. Few (<4) erect hairs on the antennal scape (cf. *D. plagiatus*)

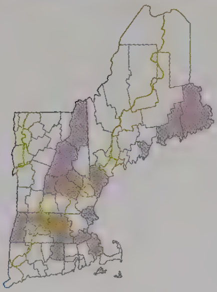
B. Scattered hairs on dorsum of mesosoma and gaster

C. Punctate sculpturing all over the body

Dolichoderus taschenbergi (Mayr, 1866)

Taschenberg's *Dolichoderus*

Honors German entomologist Ernst Ludwig Taschenberg (1818–1898).

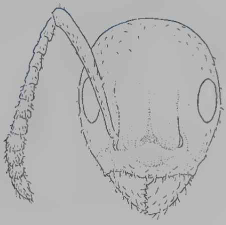


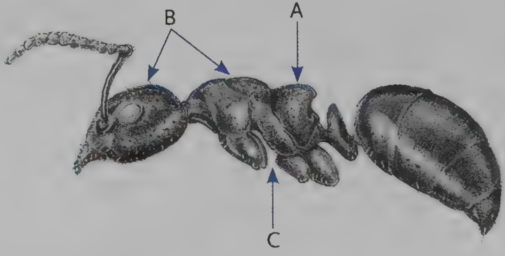
Habitat: Edges of woods, old fields, other open habitats, including bogs.

Geographic range: Nova Scotia and New Brunswick south into Georgia, Alabama, Mississippi; west across the upper Midwest and southern Canada to North Dakota, southern Manitoba.

Natural history: Colonies are huge (>10,000 workers). Nests made of piled plant debris or conifer needles. This is the most conspicuous *Dolichoderus* in northeastern pine barrens. Uses well-defined foraging trails to find prey and relocate tended aphids. Removal of aphids has little effect on the ant colony, but when the ants are removed, the aphids are unprotected and are eaten by predators.

Look-alikes: *Dolichoderus mariae;* hairiness and body color distinguish them.





Distinguishing features:

A. Length and width of propodeum nearly equal

B. Sparse, short hairs on head and pronotum (cf. *D. mariae*)

C. Uniformly brown-black

Tapinoma Förster, 1850

The Fallen Ants

From the Greek *tapeinoma*, meaning fallen or humiliated

The genus *Tapinoma* includes ~ 125 species, at least five of which occur in North America. Only two species of *Tapinoma* can be found outdoors in New England: *T. sessile* and an unnamed, workerless species that is an inquiline social parasite of *T. sessile*. A third species, *T. melanocephalum*, is a tropical tramp that occasionally turns up in greenhouses when it is imported along with tropical houseplants. The genus *Tapinoma* is recognized by its apparent lack of a node or scale on its petiole; in describing the genus, Arnold Förster named it for the "fallen" scale of the first abdominal segment (the petiole). *Tapinoma* alludes to the astrological term *tapeinoma*, which refers to planets that are fallen and do not exert their influence on human or celestial affairs.

Identifying the Species of *Tapinoma*

Of the three New England species in this genus, *T. sessile* is the most abundant and easily identified. Like *Dolichoderus*, *Tapinoma* has a gaster that ends in a distinctive horizontal, slitlike opening; there is neither an acidopore nor a stinger. The small size of *T. sessile*, the lack of a scale on its one-segmented petiole, and its characteristic odor of rotten coconuts or over-ripe bananas make it unmistakable and gave it its official common name. It can be found anywhere in North America and is abundant in New England under rocks and fallen logs in woods, bogs, and urban areas. It is also a familiar denizen of our pantries and is often referred to as a "sugar ant." Our undescribed species of *Tapinoma* is an inquiline social parasite of *T. sessile*.

Like other inquiline social parasites, members of the unnamed species of *Tapinoma* produce no workers, only queens and males, and depend entirely on their hosts for food and nest space. The unnamed social parasite can be distinguished from the host (*T. sessile*) by size: the parasite queen is about half the length of the host queen and about 80% the length of the host worker. Also, queens and males of *T. sessile* are produced and fly in July through early August, whereas the queens and males of the social parasite are produced and fly in mid-August to late-September. As of this writing, the social parasite has been collected only twice: in the early 1900s on Mount Tom in Holyoke, Massachusetts, and again in 2007 under a flowerpot in Stow, Massachusetts. Finally, the aptly named Ghost Ant, *T. melanocephalum*, is easily recognized by its dark brown head and mesosoma and its

milky white abdomen and legs. This species can be found in tropical regions throughout the world but so far has been found in New England only inside greenhouses and other warm buildings.

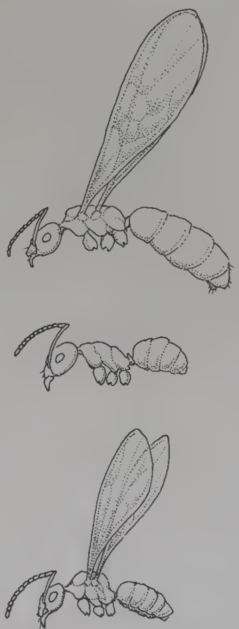
Key to the Species of *Tapinoma*

1a. **Workers tiny, <1.5 mm long;** head and mesosoma brown, gaster and legs milky white; this is a tropical species that is a rare inhabitant of greenhouses and other heated structures in New England.................... *T. melanocephalum*, p. 105

1b. **Workers larger, 2.5–3.5 mm long;** ants are uniformly brown 2

2a (1b). **Queens are generally large, at least 5.5 mm;** queens and males are produced and fly in midsummer (late July to early August)... *T. sessile*, p. 106

2b. **Queens are much smaller, 2.0–2.5 mm long;** queens and males are produced and fly in late summer (mid-August to late September); this ant is a rare inquiline social parasite of *T. sessile*. Note: workers are not produced by this species; if workers are observed in the colony, they are the workers of the host, *T. sessile* ....an undescribed species of *Tapinoma*, p. 108



Queens of *T. sessile* (top) are nearly twice as large as queens of the unnamed species of *Tapinoma* (bottom); in the center is a worker of *T. sessile*.

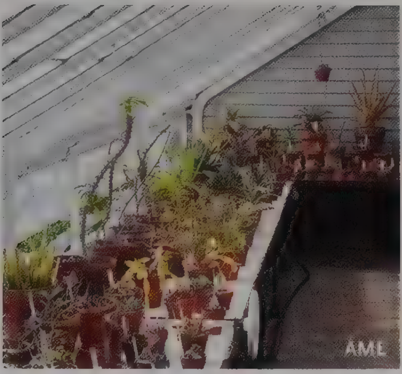
Easily Confused Species

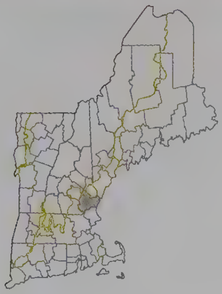
Tapinoma sessile is occasionally mistaken for the similarly sized, shaped, and colored *Lasius alienus* or the somewhat smaller *Brachymyrmex depilis*. The lack of a scale on its petiole and the termination of its gaster in a horizontal, slitlike opening are diagnostic for *Tapinoma*. The gasters of *Lasius* and *Brachymyrmex* both end in acidopores, and the antennae of *Brachymyrmex* have 9 segments, unlike the antennae of *Lasius* and *Tapinoma*, which have 12 segments.

Tapinoma melanocephalum (Fabricius, 1793)

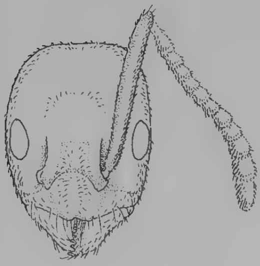
*The Ghost Ant

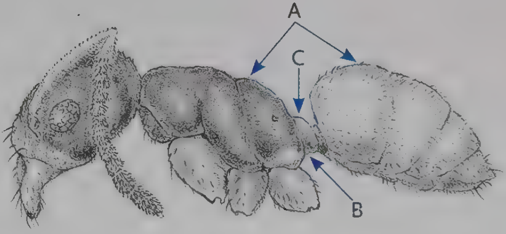
Refers to its bicoloration: *melas* + *kephale* (Gk: dark headed).





Habitat: This tropical tramp nests in pre-existing cavities made of plant materials and in larders and pantries. Indoors, nests in walls and potted plants—the only recorded habitats (so far) in New England.
Geographic range: Worldwide in tropical and subtropical regions. In North America, established in Florida north to Gainesville, in Texas, and Hawai'i. Only one New England record, from a greenhouse in southeast New Hampshire.
Natural history: Makes polydomous, polygynous colonies. Pinch this ant—the crushed body smells like rotten coconuts.
Look-alikes: None. Coloration and size unique in New England.



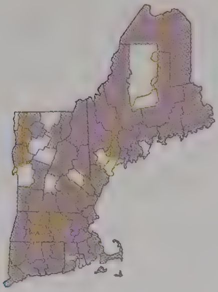


Distinguishing features:
A. Bicoloration: dark head and mesosoma, white gaster
B. Petiole hidden by the first gastral segment
C. Petiole without a scale (cf. *Lasius*)

Tapinoma sessile (Say, 1836)

*The Odorous House Ant

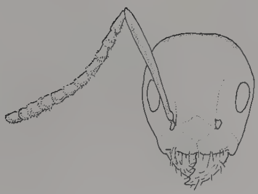
Refers to its gaster and concealed petiole: *sessilis* (Lat: stalkless).

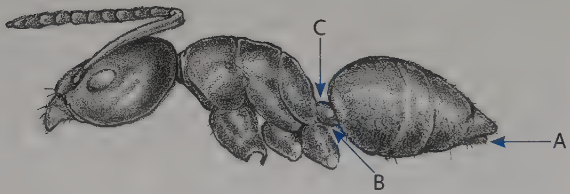


Habitat: Nests in shallow soil and under boards, rocks, debris, litter. Also found in commercial beehives and in damp spaces in houses: near pipes, heaters, and drains, and under and around toilets.
Geographic range: United States and Canada.
Natural history: Because of its propensity to forage for sugar left out on kitchen counters, *T. sessile* is one of the most common ants that you will see in New England. People often call it the sugar ant, but its official common name refers to the characteristic odor of rotten coconuts or over-ripe bananas it exudes when squeezed. Most *T. sessile* nests are outside; the workers on your counter are usually foraging along well-marked scent trails that can extend for tens of meters. But this species will also nest indoors, wherever there is enough moisture. *Tapinoma sessile* is not an aggressive ant, and some myrmecologists have hypothesized that its increasing abundance in houses and apartments has resulted from the use of insecticides to kill other species of ants that nest outside but near to houses. In addition, *T. sessile* will nest in bark mulch, which is used in suburban landscaping.

Tapinoma sessile colonies range from small to large and have one to many queens. These nests are not permanent; *Tapinoma* moves from one covered place to another every few days or so when food becomes locally scarce or when the nest is disturbed or damaged. In urban areas, however, it can form large supercolonies with multiple queens and many nests. This transition from a rural to an urban lifestyle among *T. sessile* has evolved at least four times in different parts of North America. *Tapinoma sessile* workers are scavengers, predators, and tenders of aphids and other scale insects. They forage alone but rapidly recruit nestmates to resources using scent trails.
Look-alikes: *Brachymyrmex, Lasius,* unnamed species of *Tapinoma;* presence or absence of acidopore and petiolar scale distinguish the genera. The undescribed species of *Tapinoma* has no workers and

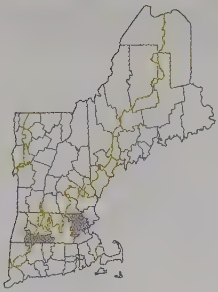
relies on *T. sessile* to care for its queens and males. If all you see are muscular males and females in late summer, you probably have a parasitized nest of *T. sessile*. Look for this parasite, which so far is known from only two records.



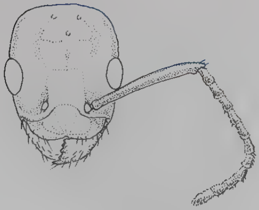


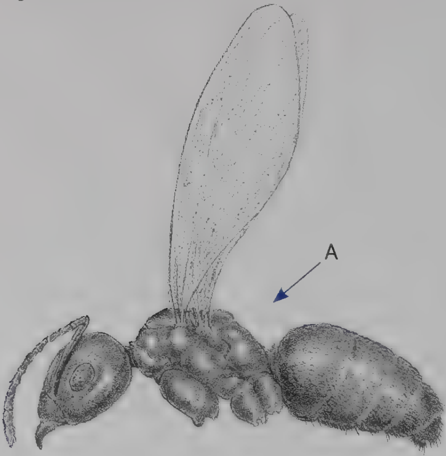
Distinguishing features:
A. Horizontal slit at end of gaster
B. Petiole hidden by first gastral segment
C. Petiole without a scale (cf. *Lasius*)

An undescribed species of *Tapinoma*



Habitat: An inquiline social parasite of *T. sessile*.
Geographic range: So far, known only from Mount Tom (western Massachusetts) and a flowerpot in Stow (eastern Massachusetts).
Natural history: Much needs to be learned about this newly discovered species of *Tapinoma*. Colonies consist of parasite queens, parasite males, and workers of the host, *Tapinoma sessile*. It is unknown if host queens are present or if they are killed by the parasite. Queens and males of the undescribed species are produced and fly in late August to mid-September, ~1 month later than those of the host. Originally described in 1915 as *Bothriomyrmex dimmocki* by William Wheeler from a specimen collected years earlier on Mount Tom in Holyoke, Massachusetts; re-evaluation of this original record revealed that the workers were small *T. sessile*, but the queens were of this undescribed species, which was rediscovered by Stefan Cover in 2007.
Look-alikes: *Tapinoma sessile;* size of queens and timing of mating flights distinguish them.



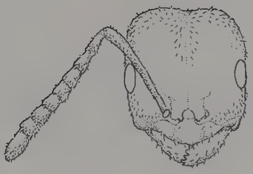


Distinguishing features:
A. Queens are very small—smaller than *T. sessile* workers.
B. Queens are produced and fly in early fall.

Brachymyrmex Mayr, 1868

The Short Ants

From the Greek *brachy*, meaning short, + *myrmex*, meaning ant, and referring to their antennae, with only 9 segments



Brachymyrmex is a Neotropical genus that includes ~ 60 species. At least 6 species, and possibly as many as 10, occur in North America, but only the widespread *B. depilis* is recorded from New England. The genus *Brachymyrmex* is in desperate need of taxonomic work. The species are minute, and taxonomists have so far failed to settle on morphological characters that might be used to separate workers of different species. Future systematic work most likely will be based on DNA sequencing, and field identification will require the invention of a *Star Trek*–type tricorder.

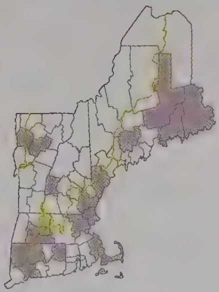
Easily Confused Species

Brachymyrmex is unique in the subfamily Formicinae in having nine-segmented antennae. Nonetheless, its small size and yellow color give it a similar appearance to paler-colored *Tapinoma sessile*, small species of *Lasius* such as *L. flavus*, or ants in the genus *Solenopsis*. Of these three genera, only *Lasius*, like other Formicinae, has an acidopore at the end of its gaster. Like other Dolichoderinae, *T. sessile* has a horizontal slit at the end of its gaster, and like other Myrmicinae, *Solenopsis* has a two-segmented pedicel (i.e., a petiole + postpetiole). *Brachymyrmex* may also be confused with other small Formicinae, such as *Nylanderia* or *Paratrechina*, but species of these latter two genera have long, erect, dark hairs on their promesonotum, whereas *B. depilis* is essentially bald on top.

Brachymyrmex depilis Emery, 1893

The Little Hairless Ant

Refers to its hairlessness: *de-* (Lat: without) + *pilus* (Lat: hair).

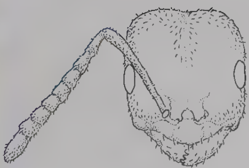


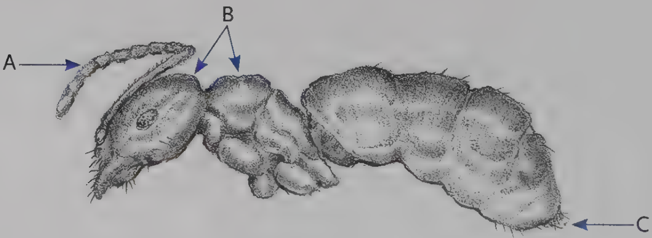
Habitat: Forests; nests under moss, stones, rotten logs, on or just below the soil surface.

Geographic range: Apparently throughout North America, but "*B. depilis*" may really be many difficult-to-separate species, each with a much narrower geographic range.

Natural history: Polygynous, intermediate-sized colonies (100s of workers) seldom seen because the colonies are underground and the workers are tiny. This habitat generalist feeds on honeydew excreted by root-feeding aphids. The soft-bodied workers appear defenseless, but they can secrete a powerful, repellent poison through their acidopore.

Look-alikes: *Nylanderia, Paratrechina, Solenopsis;* number of antennal segments separates the three Formicinae; presence of an acidopore eliminates *Solenopsis*.





Distinguishing features:

A. Short antennae (cf. *Lasius*) have only 9 segments.

B. Head and mesosoma are virtually hairless.

C. Acidopore points directly rearward (cf. *Lasius, Tapinoma*).

Camponotus Mayr, 1861

The Ants with Bending Backs
From the Greek *kampê*, meaning bent, + *nōton*, meaning back

The genus *Camponotus* is one of the most diverse ant genera in the world. It is also one of the most familiar groups of ants. Many homeowners will recognize the large black or black-and-red carpenter ants that are members of this genus. Nearly 1,600 valid species and subspecies of *Camponotus* have been described; they account for more than 10% of all the known species and subspecies of ants! There are more than 50 species in North America, 8 of which have been recorded from New England; a 9th species included in this guide is *C. subbarbatus*, which has been found on Long Island and in the Black Rock Forest on the western side of the Hudson River valley. Although it may now be scarce in the north, it is only a matter of time before *C. subbarbatus* is found in New England.

Camponotus colonies have three different sizes of workers (majors, medias or intermediates, and minors). The different castes look very different. On the species pages, we illustrate faces of larger majors and smaller minors. Minors are small, and their heads are rounded on top (posterior) and usually much longer than they are wide. Majors are large, and their heads, which are usually at least as wide as they are long, also are usually squared off at the top corners. Medias are in between. Some characters used to distinguish different species are more visible on minors than on majors, and vice versa, so accurate identification may be easier if you collect workers of different castes from the same nest.

Identifying the Species of *Camponotus*

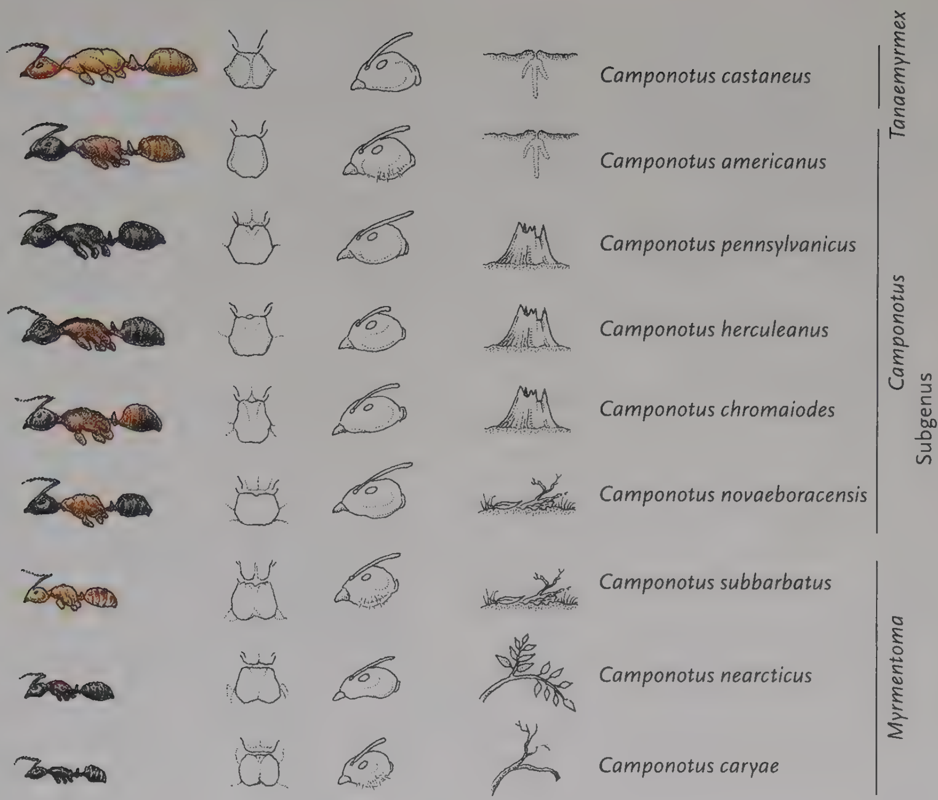
The eight New England species of *Camponotus*, along with *C. subbarbatus*, lurking on our southern and western borders, are well defined and easy to identify. There are two main groups divided by size and the presence or absence of a notch, or at least a small concavity, in the middle of the lower (anterior) edge of the clypeus. This is one of the few genera of North American ants that is still separated into more or less distinct subgenera by taxonomists. The three species of small-bodied ants (whose large, major workers are < 7.5 mm long) all have a notched clypeus and are placed in the subgenus *Myrmentoma*. The notch is most clearly visible on small minor and intermediate workers; it is often reduced to a barely noticeable medial depression on the clypeus of the largest major workers. The six species of large-bodied *Camponotus* (major workers > 7.5 mm long) that do not have a notched clypeus are currently placed in the subgenera *Camponotus* (five

species) and *Tanaemyrmex* (one species). Although some systematists consider *Tanaemyrmex* less of a true subgenus and more of a taxonomic dumping ground for species with unresolved relationships, others consider it a geographically and morphologically discrete subgenus (at least among North American representatives), with distinctive nesting habitats.

Subgenus *Myrmentoma*—The three species in the subgenus *Myrmentoma* are *Camponotus caryae, C. nearcticus,* and *C. subbarbatus. Camponotus caryae* is distinctive because it has erect hairs on its cheeks, is coal-black, and lives in dead branches or under bark high in trees. The gaster of *C. subbarbatus* has purplish stripes, and *C. nearcticus* often has some red coloration on its mesosoma. *Camponotus caryae* and *C. subbarbatus* have erect hairs on their cheeks, but *C. nearcticus* does not.

Subgenus *Tanaemyrmex*—The one New England species in this subgenus, *C. castaneus,* is uniformly colored, ranging from yellow to chestnut brown, and has a shiny gaster. It also has a raised ridge running vertically down the middle of its clypeus. Like other members of this subgenus, *C. castaneus* nests in soil, usually under large stones. Most North American *Tanaemyrmex* occur in the southern and western states, Mexico, the Florida Keys, and the Tortugas Islands. *Camponotus castaneus* is the only species in the subgenus that ranges north into the Mid-Atlantic and New England states.

Subgenus *Camponotus*—The five species in this subgenus do not have a notched or ridged clypeus. Geographically, they predominate in eastern and northern North America, rarely overlapping in distribution with subgenus *Tanaemyrmex*. The New England species in subgenus *Camponotus* are distinguished by the shininess and hairiness of their gasters, as well as by their coloration. The gasters of both *C. americanus* and *C. novaeboracensis* are very shiny. *Camponotus americanus* is bicolored: its head is always brown or black, but its mesosoma and gaster can range from black to brown or even yellow. *Camponotus novaeboracensis* also is bicolored. Its head and gaster are black, but its mesosoma and upper legs are red or burgundy colored. The remaining three species have minute pits all over their gasters; this microsculpturing gives their gasters a dull or matte appearance. *Camponotus pennsylvanicus* is the common Eastern Carpenter Ant; its uniformly black or dark brown body, long golden hairs, and long antennal scapes make it unmistakable. *Camponotus chromaiodes* is bicolored; its head and gaster are black, but its mesosoma, petiole, and portions of the first segment of the gaster are red. *Camponotus chromaiodes* is a warm-climate species that has been found as far north as southern New Hampshire; a disjunct (geographically very separate) record from Burlington, Vermont, reflects the ability of *C. chromaiodes* to take advantage of the extension of the relatively warm climate of the Eastern Great Lakes Lowlands ecoregion into northern New

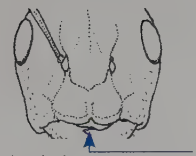


England. In contrast, the Northern or Great Carpenter Ant, *C. herculeanus*, which is mostly black but has some red on the mesonotum and also has shorter hairs and shorter antennal scapes, is found most commonly at high elevations and in cold climates throughout the Northern Hemisphere.

The matrix key above illustrates three morphological characters and one habitat character that can be used to quickly determine which species of *Camponotus* you have. Each species is shown in profile; the size shown is approximately twice the size of a major worker, and the colors illustrate both shades and bicoloration. The primary characteristic to look for on the clypeus is the presence of a ridge (*C. castaneus*) or a notch or concavity in the middle (indicating the three small-bodied species in the subgenus *Myrmentoma*). Head profiles illustrate the length of the scape relative to the length of the head of major workers and the presence or absence of cheek hairs on workers of all sizes. The nest location illustrates the most common habitats: soil or ground, dead stumps, twigs, and living or dead branches. The species are ordered from largest to smallest by subgenus: one species in subgenus *Tanaemyrmex*, five species in subgenus *Camponotus*, and three species in subgenus *Myrmentoma*.

Key to the Species of *Camponotus*

1a. **Minor and some intermediate workers with a clypeus that has a distinct notch or medial concavity;** in the largest major workers, the notch may not be apparent, but if the clypeus is not notched there will be at least a median impression or concavity on the anterior margin of the clypeus; major workers are relatively small (3.5–7.5 mm in total length) 2

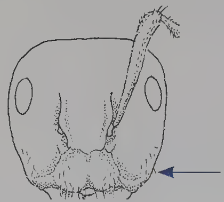


Notched clypeus on *C. nearcticus* minor workers

1b. **Both minor and major workers without a notched clypeus;** major workers are relatively large (7 to >10 mm total length) 4

2a (1a). **No erect hairs present on the cheeks** (examine the ant in full-face view); the color of the ant varies from all black to black with some red or burgundy on the mesosoma .... *C. nearcticus,* p. 122

2b. **Erect hairs present on the cheeks** 3



Erect hairs on cheeks of *C. caryae* and *C. subbarbatus*

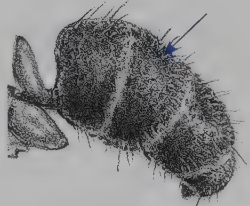
3a (2b). **Entire ant uniformly coal black** .... *C. caryae,* p. 118

3b. Body color brownish, with **striping (often purple) on gaster** .... *C. subbarbatus,* p. 125

4a (1b). **Gaster with apparent microsculpturing,** giving the surface a dull (matte) appearance; both erect and appressed hairs golden 5

4b. **Gaster surface glossy** (shiny) with little apparent microsculpturing; appressed hairs sparse or even absent; erect hairs golden 7

5a (4a). **The pubescence (appressed or flattened hairs) on the gaster is golden and relatively short,** not hiding the microsculpturing on the gaster; *on only the largest majors,* the antennal scapes are short, barely surpassing the corners of the head when observed in full-face view. There is usually some reddish color on the mesosoma .... *C. herculeanus,* p. 121



Microsculptured gaster with short pubescence of *C. herculeanus*

Camponotus

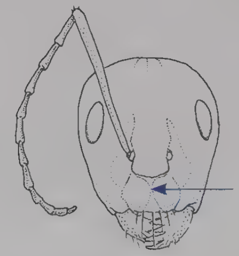
5b. **Both erect and appressed long golden hairs on the gaster cover the segments**, giving the gaster a whitish or yellowish sheen. In full-face view, the antennal scapes of all workers are long, easily surpassing the corners of the head.. 6

Microsculptured gaster with long, golden hairs, both erect and appressed, of *C. chromaidoes* and *C. pennsylvanicus*

6a (5b). **A black ant**, sometimes with lighter (dark brown) coxae (the 1st segments of the leg) .... *C. pennsylvanicus*, p. 124

6b. **A bicolored ant** whose head is black; the mesosoma, petiole, and **at least part of the 1st gastral segment are red-orange or deep red**; the remaining gastral segments are black .... *C. chromaiodes*, p. 120

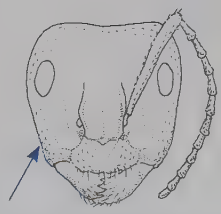
7a (4b). **A single-colored (concolorous), orange to chestnut brown ant**; in full-face view, a ridge (median carina) may be visible on the clypeus; no erect hairs on the cheeks ....*C. castaneus*, p. 119



Median ridge on the clypeus of *C. castaneus*

7b. **A bicolored ant**; there is no visible ridge on the clypeus; erect hairs on the cheeks may be present or absent 8

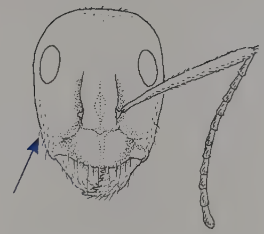
8a (7b). The ant's head and gaster are black; its **mesosoma and legs are red to burgundy**. In full-face view, there are no erect hairs on the cheeks. .... *C. novaeboracensis*, p. 123



Absence of erect hairs on the cheeks of *C. novaeboracensis*

Camponotus

8b. **The head is black to dark brown, whereas the mesosoma and gaster are variable in color—black, dark brown, or yellow (but not red).** In full-face view, erect hairs are present on the cheeks............. ....*C. americanus*, p. 117



Erect hairs on the cheeks of *C. americanus*

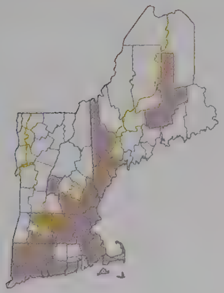
Easily Confused Species

Camponotus colonies have three different sizes of workers (majors, medias, and minors), and the small minors of the larger species can, on first glance, be confused with the large majors of the smaller species or with similarly sized *Formica* species. The profile of the mesosoma of both majors and minors is unmistakably *Camponotus* shaped (hump backed), unlike the clearly lumpy backs of *Formica* species.

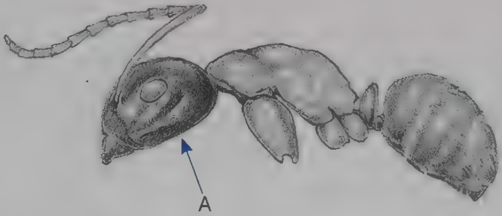
Camponotus americanus Mayr, 1862

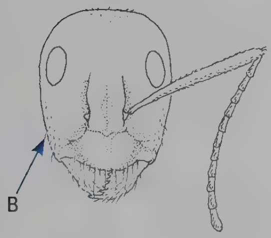
The American Carpenter Ant

Considered the carpenter ant of America (Lat: *americanus*).

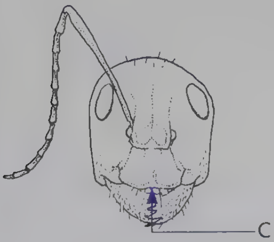


Habitat: Nests in soil and under stones in forested and open habitats.
Geographic range: The United States east of the Mississippi River (but not in Florida); Texas, Oklahoma, Nebraska, Kansas north into southeastern Canada.
Natural history: A nocturnal omnivore. A myrmecophilic rove beetle (*Xenodusa cava*) often overwinters in *C. americanus* nests.
Look-alikes: *Camponotus castaneus, C. novaeboracensis;* color, shininess, pilosity distinguish them.





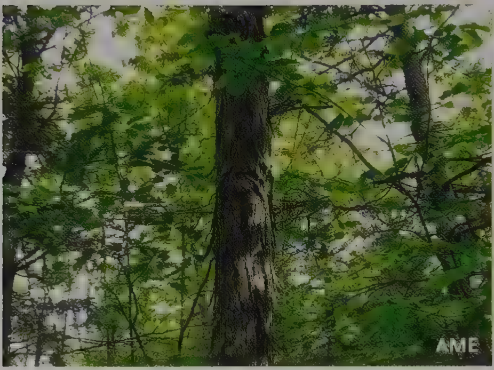
Distinguishing features:
A. Bicolored: head always darker than mesosoma or gaster
B. Hairs present on cheeks (cf. *C. novaeboracensis*)
C. Clypeus not notched (most easily seen on minor workers)

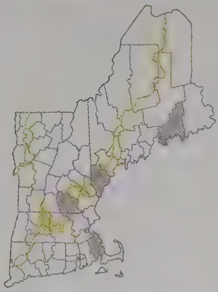


Camponotus caryae (Fitch, 1855)

The Walnut Carpenter Ant

Refers to its habitat: *karuon* (Gk: nut or walnut).



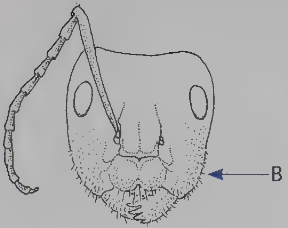


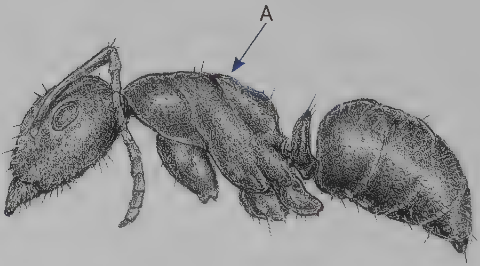
Habitat: Nests inside dead branches and stems and under bark of hickory and walnut trees.

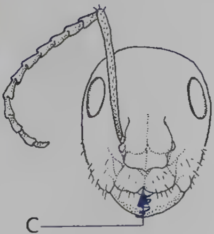
Geographic range: Eastern United States south to Florida; west to Iowa and Kansas. Five New England records to date: from Hillsborough (New Hampshire), Waterboro Pine Barrens and Acadia National Park (Maine), two of the Boston Harbor Islands (Massachusetts).

Natural history: A hard-to-find species originally described from a colony found in a piece of hickory wood in Pennsylvania; often nests in old tree holes excavated by long-horned beetles (Cerambycidae). One of only a few arboreal ants in New England, it forages on trunks and major limbs of mature oaks, walnuts, and hickories; not yet observed foraging on the ground.

Look-alikes: *C. nearcticus*, *C. pennsylvanicus* (minors); clypeus and cheek hairs distinguish them.







Distinguishing features:

A. Small, coal-black body, roughly finished (cf. *C. pennsylvanicus*)

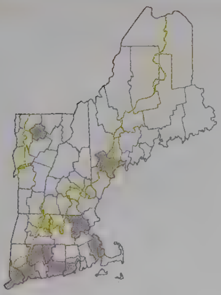
B. Hairs on cheeks (cf. *C. nearcticus*)

C. Notched clypeus, clearest on minor workers (cf. *C. pennsylvanicus*)

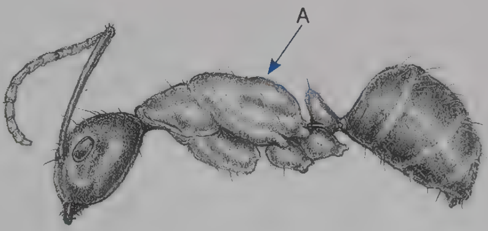
Camponotus castaneus (Latreille, 1802)

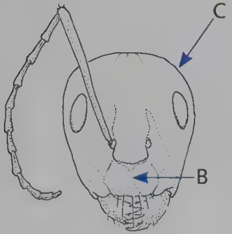
The Chestnut Carpenter Ant

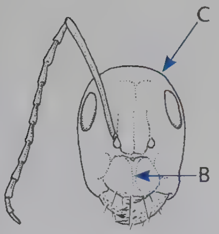
Refers to its color: *castaneus* (Gk: of chestnut color).



Habitat: Nests in soil, under rocks, or in decaying wood in the soil.
Geographic range: Southern New England, southern New York south to central Texas, Florida; west into the Midwestern states.
Natural history: A warm-climate forest dweller. Nests outdoors, not in houses, although the mainly nocturnal, omnivorous workers may forage in buildings.
Look-alikes: *Camponotus americanus;* clypeal ridge and coloration distinguish them.







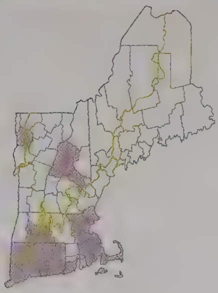
Distinguishing features:

A. Body chestnut-brown, large, shiny (cf. *C. americanus*)
B. Clypeus ridged (both major and minor workers)
C. Head rounded at upper corners (major and minor workers)

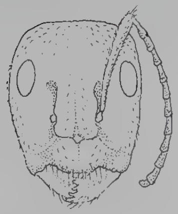
Camponotus chromaiodes Bolton, 1995

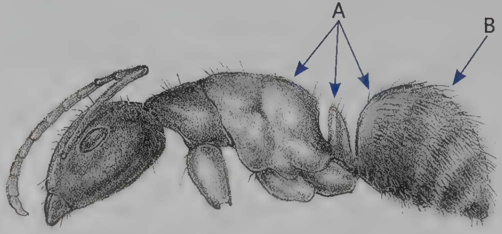
*The Red Carpenter Ant

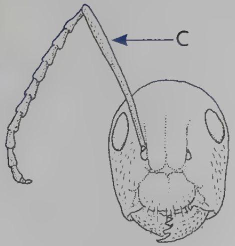
Refers to its color: *khroma* (Gk: color) + *ioeides* (Gk: violet).



Habitat: Nests in living trees, stumps, and rotted logs, rarely in houses.
Geographic range: Southern New England west to the Mississippi River. Collections of *C. chromaiodes* in New England rarely found north of Ware (south central Massachusetts); scattered records from southern New Hampshire; one record from Burlington (Vermont), in the climatically mild (by Vermont standards) Lake Champlain valley.
Natural history: A warm-climate species. A myrmecophilic carrion beetle, *Nemadus triangulum*, lives in *C. chromaiodes* nests, eating waste products of the host ant colony.
Look-alikes: *Camponotus novaeboracensis, C. pennsylvanicus;* size, color, pilosity distinguish them.







Distinguishing features:

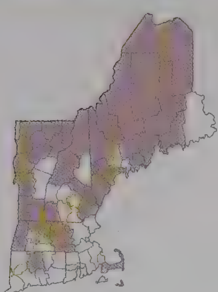
A. Mesosoma, petiole, first gastral tergite red (cf. *C. novaeboracensis*)
B. Long, golden erect and appressed hairs on the gaster
C. Scapes very long relative to head length

Camponotus herculeanus

(Linnaeus, 1758)

The Great Carpenter Ant

Refers to its size: *Herakles* (in Gk mythology, the son of Zeus and Alkmene; as a name, means great).

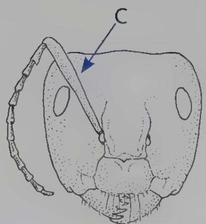


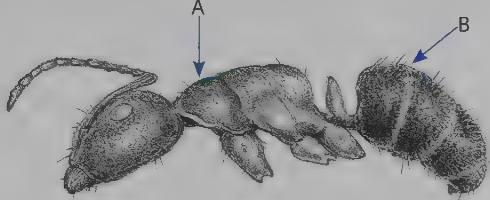
Habitat: Nests in living trees, stumps and logs, occasionally rotting beams and timbers in houses.

Geographic range: High latitudes around the world. In North America, in all the northern-tier states, in the Rocky Mountains and the Southwest at high elevations; rare in northern states with scant forests (e.g., North Dakota). In New England, common in the far north and at higher elevations; in central New England, found only in really cold spots, including Mount Washington and Mount Monadnock (New Hampshire).

Natural history: The most cold-tolerant ant species known, it can survive temperatures well below –40° C. Bears eat it in summer and fall; woodpeckers hunt for it in winter. Queens and males are produced in late summer, are fed and groomed throughout the winter, and emerge for mating flights on warm spring days. Multiple unrelated queens can coexist in a single nest.

Look-alikes: *Camponotus novaeboracensis;* color, shininess, pilosity distinguish them.





Distinguishing features:

A. Mesosoma is black on top and front, red underneath and on legs (cf. *C. novaeboracensis*).

B. Short gastral pubescence reveals microsculpturing.

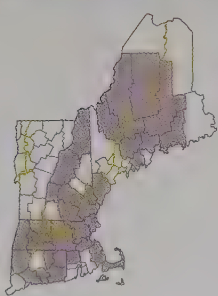
C. Scapes of largest majors are short, rarely reaching corners of head.

Camponotus

Camponotus nearcticus Emery, 1893

The Nearctic Carpenter Ant

Refers to its geographic area: *nearcticus* (Lat: the northern [Arctic] regions of the "New World").

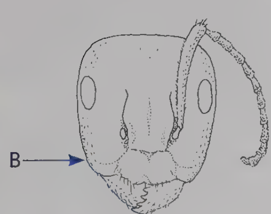


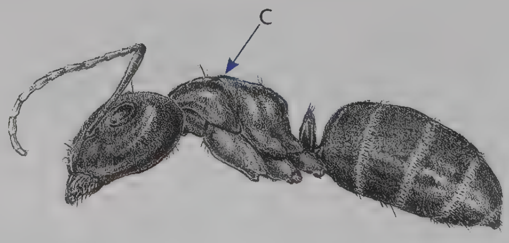
Habitat: Nests in dead branches and stems in trees, in and under wooden roofs and attics; starts small, young colonies inside old insect galls.

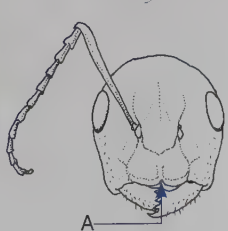
Geographic range: Southern Canada and most of the United States; less common in the Southwest and unknown from New Mexico, Arizona, Utah, Colorado.

Natural history: One of our smallest carpenter ants, it makes small colonies (<500 workers). When it does nest in houses, it rarely causes structural damage.

Look-alikes: *Camponotus caryae* and minor workers of *C. herculeanus, C. novaeboracensis, C. pennsylvanicus;* clypeus and cheek hairs distinguish them.







Distinguishing features:

A. Notched clypeus (most apparent on minor workers)

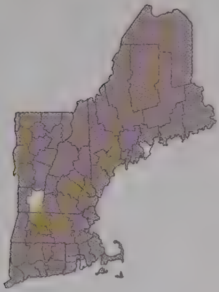
B. Cheeks without hairs (cf. *C. caryae*)

C. Bicoloration; mesosoma with some red

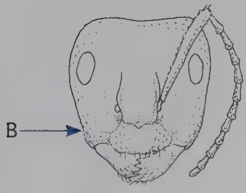
Camponotus novaeboracensis
(Fitch, 1855)

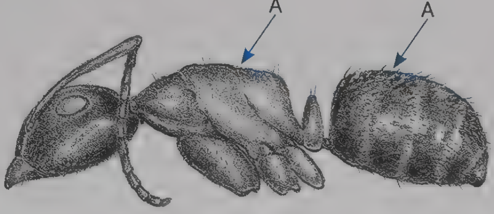
The New York Carpenter Ant

Refers to its type locality: *Nova* + *Eboraca* (Lat: New York).



Habitat: Nests in living trees, tree stumps, large pieces of downed wood; also under rocks or cow dung.
Geographic range: Northern United States south into New Mexico; north into southern Canada; less common west of the Mississippi River.
Natural history: Pupae often parasitized by small *Pseudochalcura gibbosa* wasps. The ants carry the wasp larvae back to the nest and feed them to the developing brood; the eaten become the eaters when some of the wasp larvae develop and devour the ants.
Look-alikes: *Camponotus herculeanus, C. nearcticus;* clypeus, color, pilosity, shininess distinguish them.





Distinguishing features:

A. Bicoloration: mesosoma and legs red; gaster shiny (cf. *C. herculeanus*)
B. Cheeks without erect hairs (cf. *C. americanus*)
C. Clypeus not notched (cf. *C. nearcticus*)

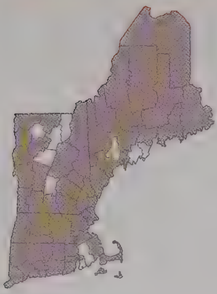
Camponotus

Camponotus pennsylvanicus

(DeGeer, 1773)

*Black or Eastern Carpenter Ant

Refers to its type locality: *Penn* (European colonist William Penn) + *sylvanicus* (Lat: of the forest), thus Pennsylvania.



Habitat: Nests exclusively in rotting wood, often in wood-framed homes and buildings.

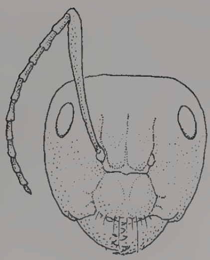
Geographic range: Eastern and Midwestern United States; southeastern and central Canada. *Camponotus modoc* replaces it west of the Rocky Mountains.

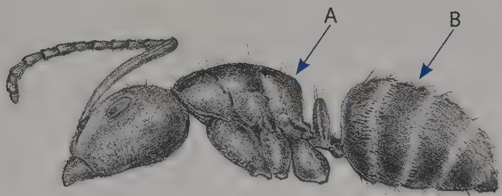
Natural history: Other than the Odorous House Ant (*Tapinoma sessile*), the Eastern Carpenter Ant is probably the most commonly encountered ant in New England. Those black ants emerging from walls, rafters, or floorboards most likely are *C. pennsylvanicus*. Although the first thought of most homeowners on seeing carpenter ants is to call the exterminator, this will rarely get rid of the ants. That's because the primary nests of *C. pennsylvanicus* are outside, in dead wood or decaying tree stumps. The nest in your house is most likely a satellite nest founded to gain more space, food, or a more hospitable place for the rearing of brood. The queen will stay outside in the main colony, while the workers will shuttle brood among the satellites. The distance from the central colony to the satellites can be as far as 200 or even 300 meters! These satellite colonies enter houses through moist areas alongside pipes and wires. They move in after the wood frame has begun to rot, so the presence of carpenter ants usually is a good indicator of other structural troubles.

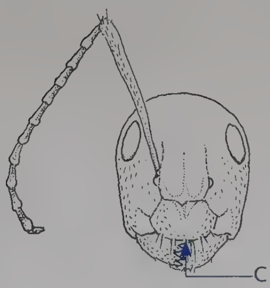
Colonies of *C. pennsylvanicus* can be enormous, with up to 15,000 workers. The workers forage mostly at night, and the colonies can live for decades. During the winter, *C. pennsylvanicus* workers will stop foraging and seal themselves into the nest. The overwintering workers, as well as the queen, store fat in their bodies that they use to keep themselves alive during the winter. They may lose almost half of these fat reserves simply surviving the New England winter. They also fill themselves with glycerol, an antifreeze-like substance that prevents ice

crystals from forming in their bodies. The freezing point of a glycerol-filled carpenter ant can be as low as –22° C, colder than even the coldest winter night in New England. No wonder these ants are so successful!

Look-alikes: Unmistakable size and appearance. Small minors may be confused with *C. nearcticus*, but *C. pennsylvanicus* has an unnotched clypeus.







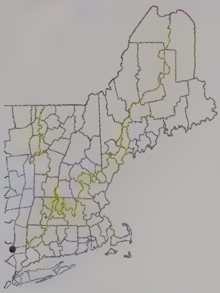
Distinguishing features:

A. Large size (often > 6 mm) and black color (cf. *C. chromaiodes*)
B. Long erect and appressed golden hairs on the gaster
C. Unnotched clypeus (cf. *C. nearcticus*)

Camponotus subbarbatus Emery, 1893

The Slightly Bearded Carpenter Ant

Refers to its hairy cheeks: *sub-* (Lat: weakly or slightly) + *barbatus* (Lat: bearded).

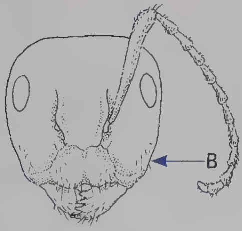


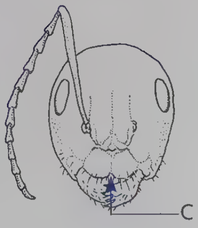
Habitat: Nests in small fallen logs, dead branches, twigs on or just above the ground.

Geographic range: New York south to Georgia; west into Ohio, Kentucky, Tennessee. No known New England records; we collected it on Long Island and at the Black Rock Forest west of New York's Hudson River.

Natural history: An omnivorous scavenger that collects honeydew excreted by aphids feeding on Maple-leaf Viburnum (*Viburnum acerifolium*), it also collects nectar and pollen from goldenrods (*Solidago*) and Black Cohosh (*Cimicifuga racemosa*).

Look-alikes: The purple-striped gaster of *C. subbarbatus* is unique in the New England myrmecofauna.





Distinguishing features:

A. Purple striping on gaster

B. Erect hairs on cheeks (cf. *C. nearcticus*)

C. Notched clypeus (most easily seen on minor workers)

Camponotus

Formica Linnaeus, 1758

The Ants

From the Latin *formica*, meaning an ant

Formica is principally a genus of temperate and boreal regions, and it is the most diverse ant genus in New England. Of the nearly 350 described species of *Formica,* at least 100 can be found in North America, and nearly a third of these have been recorded from New England. Most ants in the genus *Formica* are large (>4 mm long), and they have a clear separation between their pronotum and mesonotum that gives them a distinctive profile. This "lumpy" back makes it easy to distinguish *Formica* workers in the field from *Camponotus* workers, which have a smooth, convex profile. A range of parasitic behaviors, including temporary social parasitism, inquilinism, slave-making, and tending of scale insects and aphids, has evolved in different *Formica* species, making them fascinating study subjects for understanding the evolution of behavior in ants. Several species make large and conspicuous mounds in woodlands, at forest edges, in tree-fall gaps, and in open fields. When they occur in large numbers, these mound builders can function as important ecosystem engineers that move nutrients through the soil and change the structure and composition of the surrounding vegetation.

Identifying the Species of *Formica*

The 31 New England species of *Formica* have been placed by taxonomists into seven groups on the basis of distinctive colors, forms, and behavioral characteristics that can be seen easily in the field. The seven groups are distinguished by the shape of the head (prominently concave on top or not) and the clypeus (with or without a distinct concavity or notch on its anterior margin), color (whether the color of the head and mesosoma are the same as the color of the gaster), and whether the ant has a conspicuous silver sheen over most of its body. However, you will usually need a dissecting microscope to differentiate the species within each group.

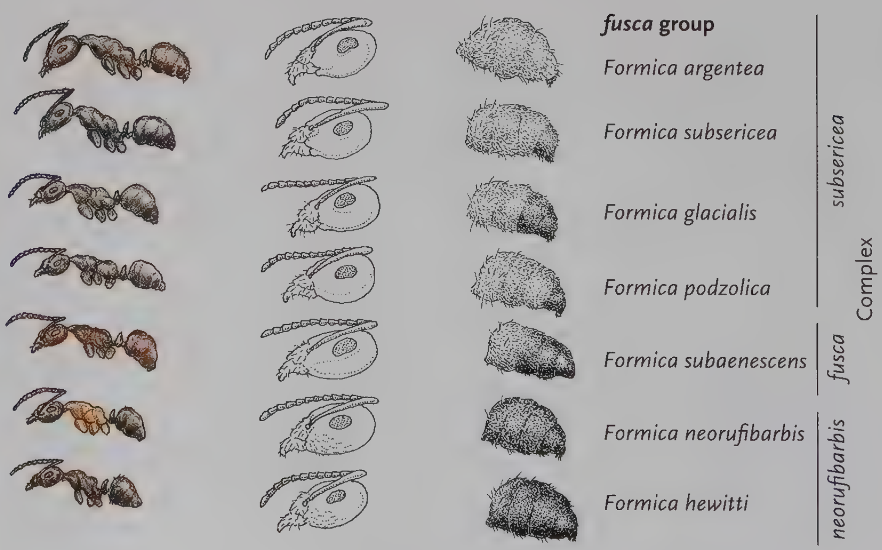
The *exsecta* group—The two New England species in this group are *F. exsectoides* and *F. ulkei*. The heads of both species have a distinctive concave top (posterior) margin, but *F. exsectoides* is virtually hairless, whereas *F. ulkei* has many hairs on its body. The head and mesosoma of *F. exsectoides* are yellowish red, light red, or medium red, whereas the head of *F. ulkei* is dark brown or black on top, grading to red below. Both species are temporary

social parasites of ants in the *Formica fusca* group: *Formica exsectoides* usually takes over nests of *F. subsericea,* and *F. ulkei* usually takes over nests of *F. glacialis.*

In temporary social parasitism, a founding queen of the parasite enters the host colony, replaces the original queen, and uses the host's workers to rear her own brood. As the host's workers age and die, the colony eventually becomes populated entirely by the parasite queen's worker offspring. These offspring then behave as normal workers, rearing the queen's brood, caring for their sisters, foraging for food, and defending the nest. Although the hosts' nests are often small mounds, once the parasites have moved in, the mounds can be greatly enlarged. *Formica exsectoides* is found sporadically in open shrublands, open woodlands, and meadows throughout most of southern New England. In contrast, *F. ulkei* is a prairie species with only a handful of disjunct occurrences in Down East Maine.

The *fusca* group—Ants in the *fusca* group are uniquely distinguished by one or two offset teeth at the base of the mandibles (the part of the mandible closest to the head). Six of the seven New England species in the *fusca* group are uniformly black or dark brown; the seventh, *F. neorufibarbis,* has a black head and gaster but a reddish mesosoma. All seven species have a pronounced silvery sheen on top of their base black or brown color that is due to the numerous flattened (appressed) silver hairs on much of their head, body, and legs. In the older literature, these species were placed in the subgenus *Serviformica.* The New England species of the *fusca* group are further subdivided into three species complexes: *neorufibarbis, fusca,* and *subsericea.*

The matrix key below illustrates the morphological characters that can be used to separate species in the *fusca* group. Each species is shown in



profile; the size shown is approximately four times that of an average worker. The species are ordered by size.

The *neorufibarbis* complex is the smallest of the group and includes *F. neorufibarbis* and *F. hewitti*. Both of these ants have coarse pits (punctures) on their cheeks that can be seen only at 25–50× magnification. *Formica hewitti* is a boreal, hairy, dark brown-to-black species, whereas *F. neorufibarbis* is a widespread, bicolored species with a black head and gaster and a dark red mesosoma.

We have only one member of the *fusca* complex (yes, it has the same name as the group!) in New England—*F. subaenescens*. This species has fewer than 10 erect hairs on the first tergite of the gaster, a dark brown-to-black body, and silver pubescence restricted to the head, promesonotum, and most prominently on the first gastral tergite of the gaster. The silver hairs may be visible, but are always sparse, on the second and third tergites.

The remaining four species are placed in the *subsericea* complex and are distinguished by the distribution of silver pubescence on their body, the length of the antennal scape relative to the length of the head, and their geographic distribution. *Formica argentea* is a brown ant that has dense silvery pubescence on its head and all four of its gastral tergites, but virtually no silver on its brown legs. The other three species are black ants that make mound nests. *Formica subsericea* has antennal scapes that are longer than the length of its head and silvery pubescence on its head, mesosoma, all its legs, and the first three segments of its gaster. *Formica glacialis* is a boreal, cold-climate species that has antennal scapes that are shorter than the length of its head; silvery pubescence on its head, mesosoma, and first two gastral tergites; and usually no (but sometimes one or two small) erect hairs on its promesonotum. Like *F. glacialis, F. podzolica* has short scapes. But in contrast to *F. glacialis,* the silvery pubescence of *F. podzolica* extends onto the third segment of its gaster, and it usually has erect hairs on its promesonotum. *Formica podzolica* also ranges farther south than *F. glacialis*. In addition to the morphological characters, these species use different materials for their nests: *F. argentea* and *F. podzolica* favor sandy soils, *F. glacialis* and *F. subsericea* favor mineral soil with higher clay content, and the remainder use dead wood along with soil to make their nests.

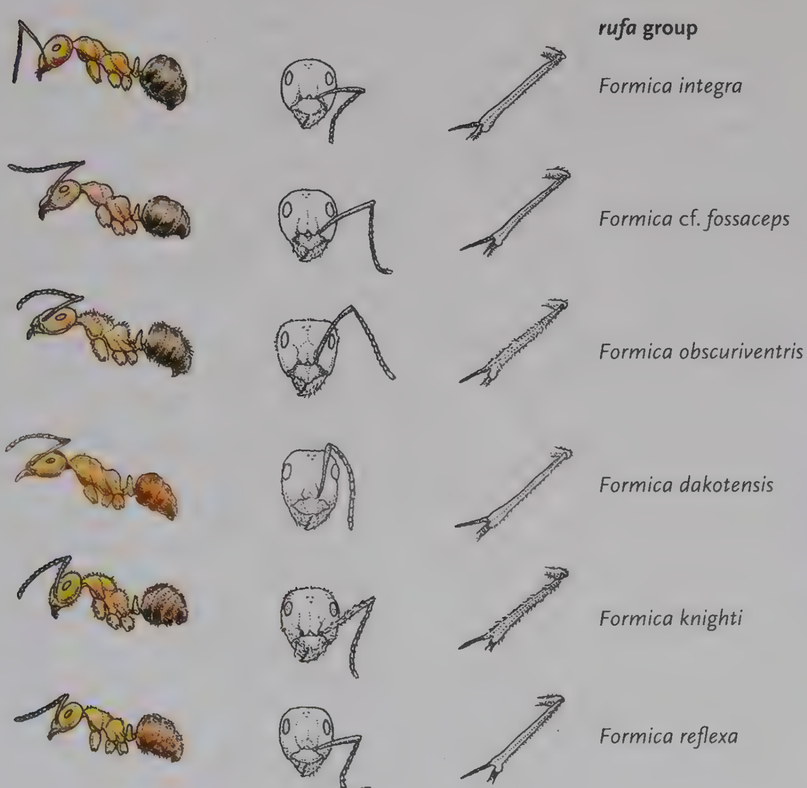
The *neogagates* group—The two New England species in this group are *F. neogagates* and *F. lasioides*. Both are uniformly brown, shiny, widespread ants that are distinguishable by habitat—*F. neogagates* is a forest dweller, whereas *F. lasioides* nests in open fields—and by the presence (in *F. lasioides*) or absence (in *F. neogagates*) of small, erect, white hairs on the antennal scape. In the field they can be distinguished from *fusca*-group ants by their sheen: *neogagates*-group ants lack appressed silver hairs and appear shiny

brown, but *fusca*-group ants with their appressed hairs glisten silvery in the sunlight.

The *pallidefulva* group—The three New England species in this group are *F. dolosa, F. incerta,* and *F. pallidefulva.* All three are large, yellowish-red to dark brown ants that nest in open or disturbed habitats such as grasslands, heathlands, and old fields. They forage during the day and make small to moderate-sized colonies (up to several thousand workers) with one or a few queens. The top (posterior margin) of the head of ants in the *pallidefulva* group, when viewed in full-face view, is noticeably rounded. They also have very long legs. In the older literature, ants in this group were placed in the subgenus *Neoformica.*

The matrix key above illustrates the morphological and habitat characters that can be used to quickly distinguish our *pallidefulva*-group species. Each species is shown in profile; the size shown is approximately four times the size of a major worker. *Formica dolosa* is the largest and lightest in color of the three; it is distinguished by the dense brush of short hairs on top of its propodeum and the dense, long hairs on its promesonotum and gaster. *Formica pallidefulva* is the most geographically widespread of the three; its promesonotum is virtually hairless, and the hairs on its gaster are short and sparse. In New England, *F. pallidefulva* tends to be light brown in color, whereas it may be lighter in color farther south. It is the only one of the three *pallidefulva*-group species that commonly ranges into woodlands. Finally, the body of *F. incerta* is generally red in color and darker toward the tip of the gaster; it may appear distinctly bicolored. The hairs on the promesonotum of *F. incerta* are short; it has dense but short hairs on its gaster; and it has fewer hairs on its propodeum than *F. dolosa.* Like *F. dolosa,* it is generally found in open habitats. A fourth species in this group, *F. biophilica,* is neither pictured in the matrix nor detailed later. It is intermediate in hairiness between *F. dolosa* and *F. incerta,* but the hairs are curved and tapering (as opposed to short and blunt in *F. incerta*). *Formica biophilica* has been recorded only as far north as Long Island. As the climate warms, you may find this species in southern New England.

The *rufa* and *microgyna* groups—Workers of these bicolored ants have red heads and mesosomas and dark gasters, and, like species in the *exsecta* group, they are temporary social parasites on other *Formica* species. In Europe, members of the *rufa* group are often referred to as wood ants; the European wood ant *F. rufa* makes large mound nests, and it is considered an invasive species in parts of southern Ontario. But both wood ants and *microgyna*-group ants in New England tend to be sparsely distributed and inconspicuous. The two groups are distinguished by the sizes of their queens relative to the largest workers in the nest: ants in the *rufa* group have queens that are larger than the largest worker, whereas ants in the *microgyna* group have queens that are smaller than the largest worker. If there are hairs on the promesonotum, these hairs are long and tapering in *rufa*-group ants and tend to be shorter and club or spoon shaped in *microgyna*-group ants. Unfortunately, however, not all of the *rufa* and *microgyna* species have hairs, so this character is useful only some of the time. Similarly, in most cases the heads of *rufa*-group ants are wider than they are long, and the heads of *microgyna*-group ants are longer than they are wide. However, there can be substantial variability in this character, and it is not, by itself,

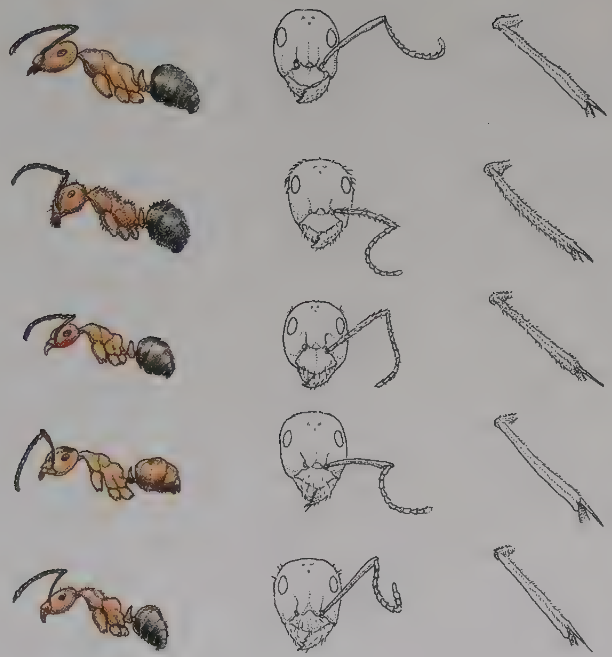


a dependable character with which to separate the two groups. It is currently thought that the *microgyna* group evolved from a *rufa*-group ancestor, but ongoing systematic work will likely rearrange our current placement of these two groups on the *Formica* evolutionary tree.

The matrix key on p. 131 illustrates morphological characters that can be used to distinguish among the New England species of the *rufa* group. The ants are ordered by size and are drawn approximately four times life-size. The two smallest species have unique hairs: *F. knighti* has a few erect hairs protruding from between the facets of its compound eyes (best seen at 25–50× magnification), and short, copper-colored hairs on its mesosoma, tibiae, and gaster, which also has dense gray to silvery pubescence. It often has a splash of yellow on the front of its gaster, just behind the petiole. *Formica reflexa* has hairs on its gaster that bend downward at the tips, forming little loops. The four remaining species in the *rufa* group are distinguished by hairiness, the shape of the clypeus, and the petiole. *Formica obscuriventris* is hairy all over and has erect hairs on all sides of its rear tibiae. *Formica dakotensis* is much less hairy than *F. obscuriventris:* it has hairs on its pronotum and gaster, but not on its mesonotum, and has erect hairs only in two rows along the inner surfaces of its middle and rear tibiae. *Formica dakotensis* also has a unique, square-sided petiole (viewed from the back). Finally, *Formica integra* and *F.* cf. *fossaceps* are shiny, virtually hairless ants that have erect hairs only in two rows along the inner surfaces of their middle and rear tibiae. But *F. integra* has an evenly curved clypeus, whereas the sides of the clypeus of *F.* cf. *fossaceps* are pinched in on either side.

Both the workers and the queens of *microgyna*-group *Formica* species can be distinguished by their colors, hairs, and characteristics of their faces and tibiae. Even though workers are collected more frequently than queens, characteristics of queens often are more useful than characteristics of workers. Thus, we present matrix keys for both workers and queens of ants in the *microgyna* group. Note, however, that *F. morsei* is known from only a single collection of three workers, and *F. dirksi* is known from only a single queen.

The matrix key on p. 133 illustrates differences among *microgyna*-group workers. The ants are illustrated approximately five times life-size and are ordered by size from largest to smallest. Most of these bicolored ants have red heads, red mesosomas, and black gasters, but the head and mesosoma of *F. nepticula* is a dark burgundy, whereas the head and mesosoma of the type specimen of *F. morsei* has faded over time to more yellow-red than red; we cannot be sure about the true colors of *F. morsei*. The most common *microgyna*-group ant collected in New England is *F. querquetulana*. Workers of this species have a handful of sparse, erect hairs on their bodies, and only two rows of erect hairs on the inner surface of the rear tibiae. Most notably,



microgyna-group workers
Formica querquetulana

Formica impexa

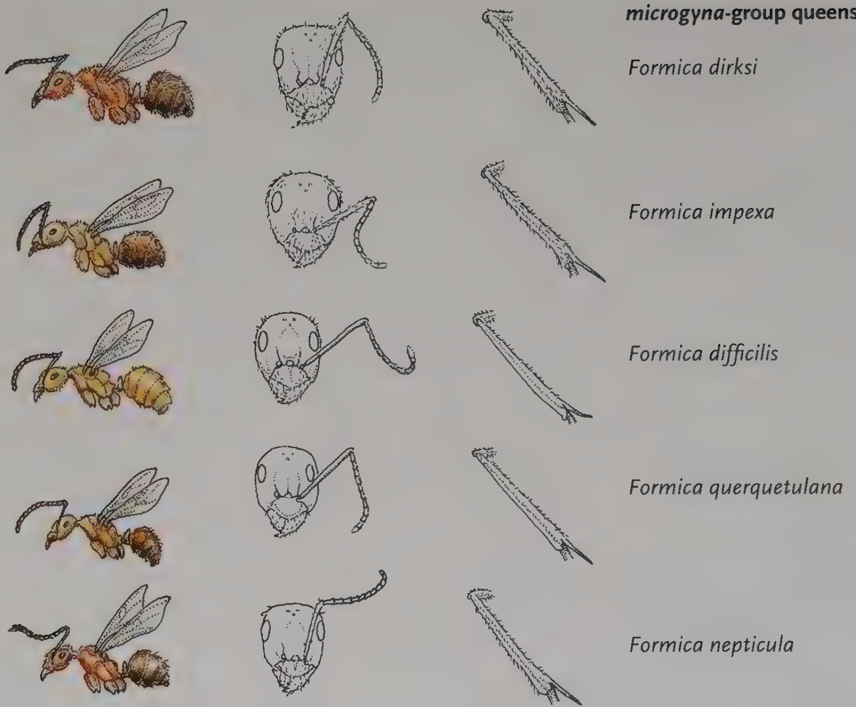
Formica nepticula

Formica morsei

Formica difficilis

however, *F. querquetulana* lacks hairs on the upper corners of its head, and it is not at all shiny. *Formica morsei* is superficially similar to *F. querquetulana*, but it is unique among the New England *microgyna*-group species in that the top of its head is evenly convex and its head is as wide as it is long (all the rest have heads longer than they are wide). This species, however, is known from only a single nest, and we know only the name of the town—South Natick, Massachusetts—in which it was originally collected. *Formica difficilis* can be mistaken for *F. querquetulana*, but *F. difficilis* is distinguished by the erect hairs on the upper corners of its head, and its head is a little shinier than its mesosoma. Likewise, *F. nepticula* has hairs on the upper corners of its head, but it also has erect hairs on all surfaces of its rear tibiae, whereas *F. difficilis*, like *F. querquetulana*, has erect hairs only in two rows on the inner surface of its hind tibiae. Finally, *F. impexa*, like *F. nepticula*, has many erect hairs on all surfaces of its hind tibiae. But *F. impexa* is a very hairy ant, with many erect hairs all over its body and around the top of its head.

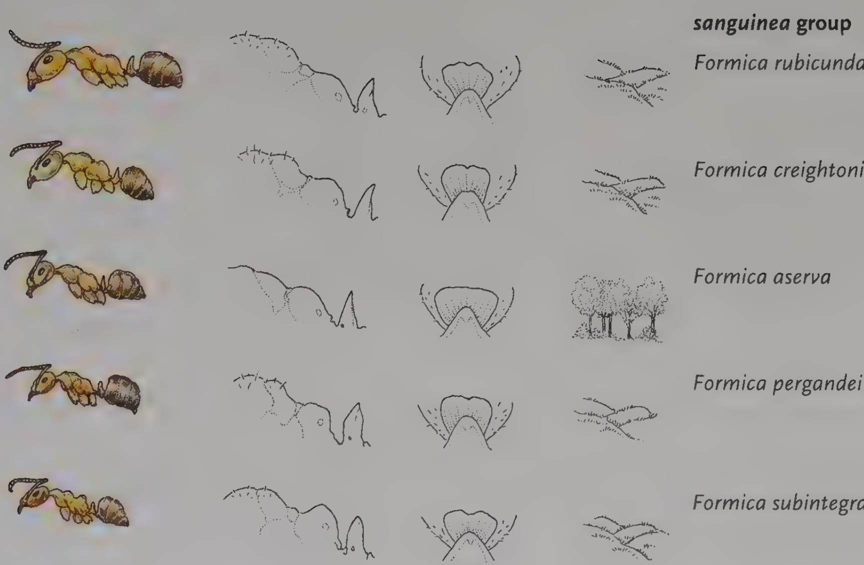
The matrix key on p. 134 illustrates differences among *microgyna*-group queens. These queens are drawn five times life-size; they are generally 5–25% *smaller* than their corresponding workers. The queens of *F. impexa* and *F. nepticula*, along with *F. dirksi* (which is known from only a single queen collected in 1946 in Daigle, Maine), have many erect hairs on all surfaces of their hind tibiae. In contrast, queens of *F. difficilis* and *F. querquetulana* have only two rows of erect hairs on the inner surfaces of their hind tibiae.



Likewise, the hairs on the upper corners of the head help to distinguish among the species. *Formica querquetulana* has none; *F. difficilis, F. nepticula,* and *F. dirksi* have sharp, erect hairs on the corners of their heads, but the hairs on the corners of the head of *F. impexa* are flattened horizontally. The colors of the queens are often different from those of the workers, however. *Formica difficilis* queens are uniformly yellow; *F. impexa* and *F. querquetulana* queens are bicolored with yellow heads, yellow mesosomas, and brown gasters; *F. dirksi* queens are bicolored with red heads and mesosomas and dark brown gasters; and *F. nepticula* queens, while variable in color, are most often uniformly brown.

The *sanguinea* group—The five New England species in this group are *F. aserva, F. subintegra, F. rubicunda, F. creightoni,* and *F. pergandei*. In older literature, ants in this group were placed in the subgenus *Raptiformica*. All of these slave-making ants have a distinct median concavity or notch in the anterior margin of the clypeus. These species are also bicolored ants; their heads and mesosomas are red or reddish-orange, and their gasters are dark brown or black. They raid nests of ants in other *Formica* groups, taking brood back to their home nests to be raised as slaves.

The matrix key on p. 135 illustrates three morphological characters and one habitat character that can be used to identify species in the

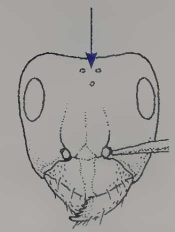


sanguinea group. Each species is shown in profile; the size shown is approximately four times the size of a large worker, and species are ordered by size from largest to smallest. The colors illustrate both shades and bicoloration. First, look at the shape of the crest of the petiole, viewed from the front. *Formica aserva* has a broad, evenly rounded, fan-shaped scale, whereas the others have more narrow scales, usually with a small notch or concavity at the crest. *Formica aserva* is more commonly found in forests than are the other four species, which are collected more frequently in disturbed or open habitats. Next, look at the mesosoma in profile, noting whether there are hairs, their shape and size, and the overall body shape. *Formica aserva* is hairless, *F. subintegra* and *F. rubicunda* have short (<0.14 mm) bristlelike hairs, and *F. creightoni* and *F. pergandei* have long (>0.1, usually >0.2 mm) tapered hairs. *Formica subintegra* and *F. rubicunda* can be distinguished by the shape of their mesosoma and petiole viewed in profile: *F. subintegra* has a blunt-topped scale and a "saddle-backed" mesosoma, whereas *F. rubicunda* has a sharp-topped scale and a more rounded mesosoma in which the propodeum is much lower than the mesonotum. Both *F. subintegra* and *F. rubicunda* enslave ants in the *fusca* group. Finally, *F. creightoni* and *F. pergandei* can be distinguished by their head shape and the relative lengths of their antennal scapes and head: *F. creightoni* has a long, narrow face and scapes that extend well beyond the corners of the head, whereas *F. pergandei* has a short, wide face and scapes that rarely extend beyond the corners of the head. *Formica pergandei* is widespread in New England, but *F. creightoni* is so far known only from two locations in Massachusetts.

Key to the Species of *Formica*

1a. **Top (posterior margin) of head distinctly concave;** nests are large-sized mounds that can exceed 1 m in diameter .... (*exsecta* group) 2

1b. **Top (posterior margin) of head not distinctly concave;** nests variable in size 3



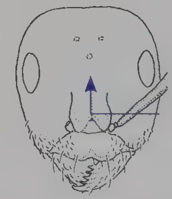
Concave head of the *exsecata* group

2a (1a). **Ant virtually hairless;** head and mesosoma yellow-red, gaster dark .... *F. exsectoides,* p. 154

2b. **Ant has many erect hairs;** head dark on top, red below; mesosoma red, gaster black .... *F. ulkei,* p. 176

3a (1b). **Clypeus notched;** ant bicolored (head and mesosoma reddish orange, gaster dark); these ants are slave-makers .... (*sanguinea* group) 4

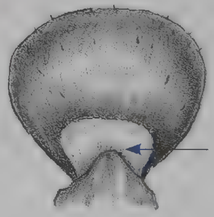
3b. **Clypeus not notched;** ant may be either concolorous or bicolored; these ants are free-living or temporary social parasites 8



Notched clypeus of the *sanguinea* group

4a (3a). **Few (normally <6) very short (<0.06 mm) hairs or no erect hairs on dorsum or gaster;** petiole large (broad), fan-shaped, and lacking erect hairs on its crest; this is a northern species found at high elevations in Massachusetts as well as throughout northern New England .... *F. aserva,* p. 148

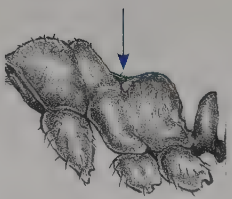
4b. **At least 6 hairs > 0.06 mm long on dorsum and gaster;** petiole with at least a shallow notch at the crest and with 1 or more erect hairs on its crest 5



Hairless, fan-shaped petiole of *F. aserva*

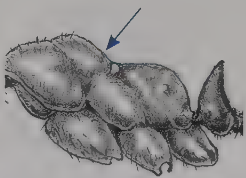
5a (4b). **Erect hairs on the dorsum of the mesosoma and gaster short (0.06–0.14 mm),** stiff, and bristlelike, usually flattened and blunt tipped or abruptly tapered; these ants enslave only ants in the *fusca* group 6

5b. **Erect hairs on the dorsum long (0.10–0.25 mm),** evenly tapering to the top; these ants enslave ants of many *Formica* groups 7



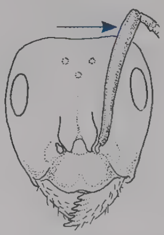
Saddle-backed mesosoma of *F. subintegra*

6a (5a). **Mesosoma saddle backed in profile; erect hairs absent on the propodeum;** crest of petiole blunt in profile .... *F. subintegra*, p. 174



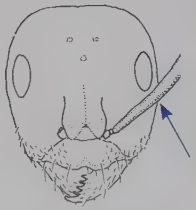
Curvaceous mesosoma of *F. rubicunda*

6b. **Mesosoma more curvaceous in profile; erect hairs present on the propodeum;** crest of petiole sharp......................... *F. rubicunda*, p. 172



Face of *F. pergandei*, wider than long, and scape shorter than head

7a (5b). **Head at least as broad as it is long, usually broader;** scape shorter than the length of the head; erect hairs on the gaster $\geq$ 0.13 mm long; hairs on the second gastral tergites dense and closely packed (separated by a distance less than their own length); this ant enslaves *neogagates*, *pallidefulva*, and *fusca*-group ants; it is widespread throughout New England .... *F. pergandei*, p. 168



Face of *F. creightoni*, longer than wide, and scape longer than head

7b. **Head distinctly longer than it is broad;** the antennal scape is longer than the length of the head; erect hairs on the gaster < 0.13 mm long; erect hairs on the second gastral tergite separated by at least 0.1 mm (longer than the lengths of the hairs themselves); this ant enslaves *neogagates*-group ants; it is a Midwestern species rarely collected in New England................................ *F. creightoni*, p. 149

Formica

8a (3b). **Ants with distinct silvery appressed hairs (pubescence)** on the head, mesosoma, and gaster and sometimes on the legs; mandibles with 1 or 2 offset teeth at the base of the mandible (the part of the mandible nearest the head); these ants are concolorous (brown to black) or bicolored (black head and gaster, red mesosoma); body surface usually shiny ....(*fusca* group) 9

8b. **Ants lacking silvery pubescence** on body surfaces; mandibles without offset teeth at the base of the mandible; body color variable; body surface shiny or dull.. 15

9a (8a). **The region of the cheek between the eye and the insertion of the mandible is covered with coarse, elongated punctures** that are widely spaced in the posterior half of the cheek.............................. ....(*neorufibarbis* complex) 10

Coarse cheek punctures of the *neorufibarbis* complex

9b. **The region of the cheek between the eye and the insertion of the mandible is without coarse, elongate punctures**.. 11

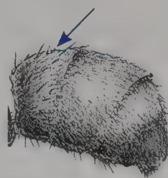
10a (9a). **A brownish-black or black ant with a hairy body**; the hairs are short on the mesosoma, the dorsal margin of the petiole, and the dorsum of the gaster............................. *F. hewitti*, p. 156

10b. **A bicolored ant** in which the posterior half of the head and the anterior gaster are black, whereas the front half of the head and the mesosoma are dark red (specimens collected in bogs are occasionally concolorous brown or black); hairs lacking (or < 5) on the head, promesonotum, and petiole; these ants are widespread in New England............................. ....*F. neorufibarbis*, p. 164

11a (9b). **Many fewer than 10 erect hairs (average = 4) on the first gastral tergite** (*not* including the hairs on the posterior edge of the first segment); body brown-black; silvery pubescence apparent on the head and mesosoma, but absent or faint on the gaster and legs .... *F. subaenescens*, p. 173

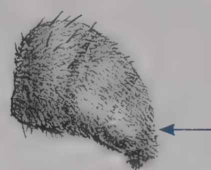
Fewer than 10 erect hairs on the first gastral tergite of *F. subaenescens*

11b. **Usually more than 10 erect hairs on the first gastral tergite** (*not* including the numerous hairs on the posterior edge of the first segment); body black or brown-black; silvery pubescence pronounced on most body parts, noticeably on the gaster .... (*subsericea* complex) 12



Many more than 10 erect hairs on the first gastral tergite of *subsericea* complex

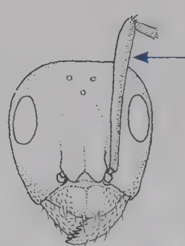
12a (11b). **A brown ant; silvery pubescence dense on head, mesosoma, and all 4 gastral segments but usually absent on legs** .... *F. argentea*, p. 147



Dense silvery pubescence on all four gastric segments of *F. argentea*

12b. **Black or brown-black ants; silvery pubescence present on legs and on first 3 gastral segments** but sparse to absent on 4th gastral segment 13

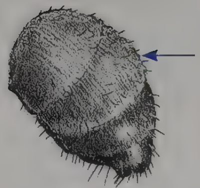
13a (12b). **The length of the antennal scape is longer than the length of the head;** fine, sparse pubescence on head, mesosoma, all legs, and gastral segments 1–3 .... *F. subsericea*, p. 175



Long scape of *F. subsericea*

13b. **Scape equal in length to or shorter than the length of the head**; pubescence variable..14

14a (13b). **Promesonotum usually lacking hairs**; dense silvery pubescence on segments 1–2, fading on segment 3; this ant is found in boreal, cold climates .... *F. glacialis*, p. 155



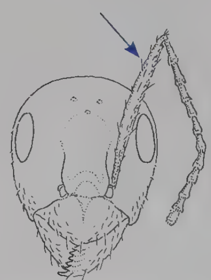
Dense silvery pubescence on the first two gastral segments of *F. glacialis*

14b. **Promesonotum usually with erect hairs**; silvery pubescence prominent on segments 1–3; this ant extends into warmer climates............................ .... *F. podzolica*, p. 169

15a (8b). **Brown-to-black concolorous ants**.......... ....(*neogagates* group) 16

15b. **Yellow-to-red concolorous or bicolored ants** (head and mesosoma red or yellowish red, gaster brown to black) 17

16a (15a). **An ant of open fields; at least 3 white, erect hairs on scape** (not including hairs at the junction of the scape and the funiculus).......................... .... *F. lasioides*, p. 161



At least three erect, white hairs on the scape of *F. lasioides*

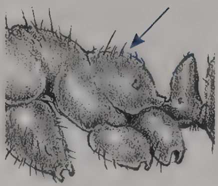
16b. **An ant of forests; no (or rarely 1–2) erect hairs on scape**; this ant is brown, smooth, and shiny................. *F. neogagates*, p. 163

17a (15b). **Large yellow-to-red or reddish-brown, mostly concolorous, shiny ants**; eyes large (eye nearly as long as cheek); top of the head strongly rounded; body long and slender (mesosoma nearly 2× as long as high).................................... .... (*pallidefulva* group) 18

Formica

17b. **Bicolored, dull-surfaced ants;** eyes smaller (eye usually 30% smaller than cheek); top of head more squared off; body more compact (mesosoma < 1.8× as long as high) .... (*rufa* and *microgyna* groups) 20

18a (17a). **A large, hairy ant with a visible brush of many (>20) long, erect hairs on the propodeum;** gaster densely pubescent; crest of petiole rounded (convex) on top; erect hairs on gaster dense and long .... *F. dolosa*, p. 153



Many erect hairs on propodeum of *F. dolosa*

18b. **Only a few (much < 20) short, erect hairs on the propodeum;** hairs may be present or absent on the mesosoma; shine of the gaster is visible between hairs of the pubescence 19

19a (18b). **At least 5 hairs on the mesosoma; long, dense hairs on the gaster; and 1 to several long hairs on the propodeum;** this is a shiny red or reddish-brown ant with little sculpturing on the mesosoma and gaster; found in open fields, grasslands, and heathlands .... *F. incerta*, p. 158

19b. **No (or certainly < 5) hairs on the mesosoma and short, sparse hairs on the gaster;** this is a shiny yellow-brown to dark brown ant found in open- and closed-canopy forests......... *F. pallidefulva*, p. 167

20a (17b). **Middle and hind tibiae of workers with 2 rows of white, erect hairs on their inner surfaces**; the head is distinctly longer than broad; the top (posterior) of the head is rounded and evenly convex ....*F. morsei*, p. 162

20b. **Middle and hind tibiae of workers (and queens) with 2 or more rows of black or copper-colored erect hairs** (rarely white); head proportions vary from broader than long to longer than broad; posterior head shape rounded to more square 21

21a (20b). **Middle and hind tibiae of workers and queens with 2 rows of erect hairs on their inner surface** 22

21b. **Middle and hind tibiae of workers and queens with hairs on all surfaces** 27

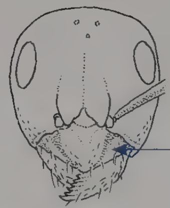
Many erect hairs on all surfaces of the hind tibia of *F. dirksi*, *F. impexa*, *F. knighti*, *F. nepticula*, and *F. obscuriventris*

22a (21a). **Erect hairs absent on the dorsum of the mesosoma and also absent on the top edge (posterior margin) of the head** 23

22b. **Erect hairs present at least on the dorsum of the pronotum, often elsewhere on the mesosoma; erect hairs present or absent on the posterior margin of the head** 24

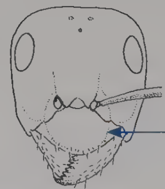
Formica

23a (22a). **Median lobe of the clypeus descending abruptly to the clypeal fossae; the sides of the clypeus make an angle with its upper face, giving the clypeus a pinched look** .... *F.* cf. *fossaceps*, p. 177



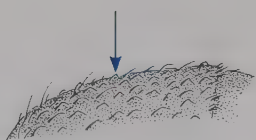
Pinched clypeus of *F.* cf. *fossaceps*

23b. **Median lobe of the clypeus descending gradually to the clypeal fossae, giving the clypeus a smooth look** .... *F. integra*, p. 159



Smooth clypeus of *F. integra*

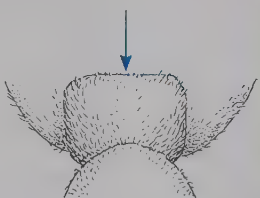
24a (22b). **Hairs on gaster erect at base but reflexed at tip, forming little loops**; crest of petiole extremely thick and rounded in profile. .... *F. reflexa*, p. 171



Reflexed hairs on the gaster of *F. reflexa*

24b. **Hairs on gaster not reflexed**; petiole shape variable 25

25a (24b). **Petiole, viewed from behind, appears square, with a nearly flat top and parallel sides** .... *F. dakotensis*, p. 150



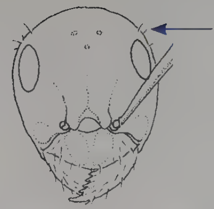
Square-topped petiole of *F. dakotensis*

25b. **Petiole not square, with a convex top and tapered or curved sides** 26

Formica

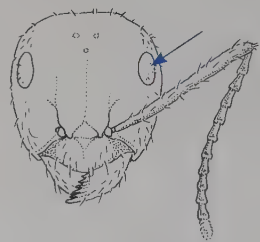
26a (25b). **Erect hairs present on the corners of the head**....... *F. difficilis*, p. 151

26b. **Erect hairs absent on the corners of the head** .... *F. querquetulana*, p. 170



Erect hairs at the corners of the head of *F. difficilis*

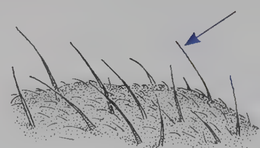
27a (21b). **A few erect hairs on the compound eyes** (visible at 25–50×) and scapes; **dense, copper-colored hairs on the mesosoma and gaster,** overlaying dense gray to silvery pubescence; there is often a splotch of yellow color on the anterior part of the gaster .... *F. knighti*, p. 160



Erect hairs on the compound eyes of *F. knighti*

27b. **No hairs on the compound eyes; hairs on body not copper colored;** no yellow splotches on the gaster 28

28a (27b). **Hairs on pronotum sharp and tapered (thinner at the top than at the bottom);** queens at least as large as the largest worker; body very hairy ....*F. obscuriventris*, p. 166



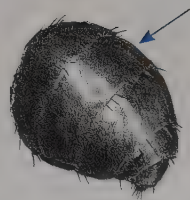
Sharp hairs of the *rufa* group

28b. **Hairs on pronotum blunt, clublike (clavate), or spoonlike (spatulate), wider at the top than at the bottom;** queens smaller than the largest worker................ 29

Blunt hairs of the *microgyna* group

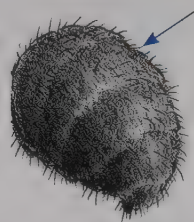
Formica

29a (28b). **Gaster with very short and sparse pubescence that does not hide the surface sculpturing**; this is a shiny ant with a dark red to burgundy-colored head and mesosoma and a black gaster; workers have many erect hairs on the antennal scape, but queens have at most 3–5 erect hairs on the scape................................. *F. nepticula*, p. 165



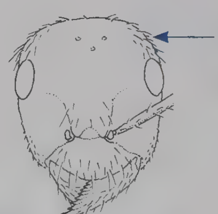
Shiny, nearly hairless gaster of *F. nepticula*

29b. **Gaster with long and dense pubescence that hides the surface sculpturing**; this is a dull-surfaced ant with a red or yellow head and mesosoma and a brown or black gaster; both workers and queens have many blunt-tipped, erect hairs on the antennal scape.......... 30



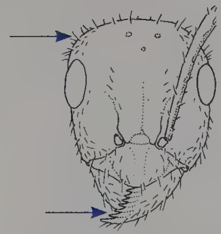
Hairy, matte, hairy gaster of *F. impexa* and *F. dirksi*

30a (29b). **Queen with flattened or horizontal erect hairs on the upper corners of the head; mandibles with 8 teeth**; workers with many erect hairs all across the top of the head; erect hairs on legs whitish or pale yellow.................................. *F. impexa*, p. 157



Flattened hairs at head corners of *F. impexa* (queen)

30b. **Queen with upright erect hairs on the upper corners of the head; mandibles with 7 teeth;** workers unknown............................ *F. dirksi*, p. 152



Erect hairs at head corners of *F. dirksi* (queen)

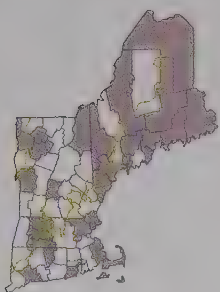
Easily Confused Species

Workers of the large *Formica* species, with their lumpy profiles, are generally unmistakable, but queens, with their large mesonotal muscles and even larger size, have more convex profiles and can be mistaken for *Camponotus* workers or queens. It is also possible to confuse *F. neogagates* with *Prenolepis imparis*. Both are shiny brown ants, but *P. imparis* has a distinctive hourglass shape to its promesonotum in dorsal view (i.e., when viewed from above), and it also lacks ocelli on its head. The only other comparably sized ants are *Aphaenogaster treatae*, which is distinguishable by its two-segmented pedicel, and *Polyergus* species, which are distinguishable by their toothless, sickle-shaped mandibles.

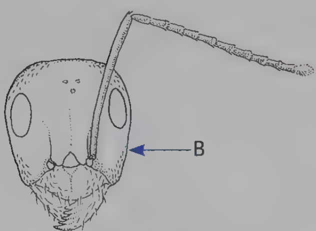
Formica argentea Wheeler, 1902

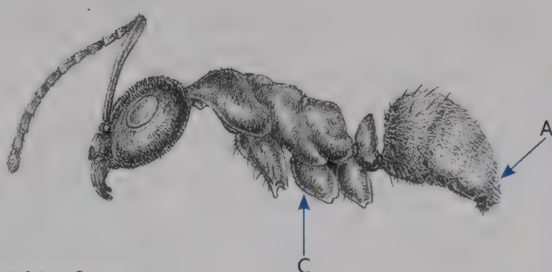
The Silver Ant

Refers to the abundance of sliver hairs on its body: *argentum* (Lat: silver).



Habitat: In New England, sandy soils in open habitats.
Geographic range: Abundant in north central North America; sparse west into California, east into Quebec. Throughout New England, most commonly in Maine.
Natural history: A species of disturbed areas and open habitats.
Look-alikes: *Formica subsericea;* degree of silvery pubescence on gaster and legs distinguishes them; base color differs less reliably.



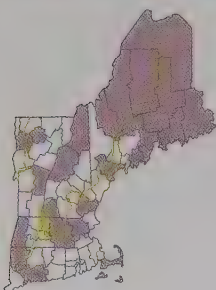


Distinguishing features:
A. Silvery pubescence on gastral tergites 1–4 (cf. *F. subsericea*)
B. Cheeks without elongated punctures (cf. *F. hewitti*)
C. Brown body color

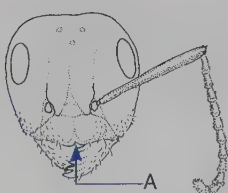
Formica aserva Forel, 1901

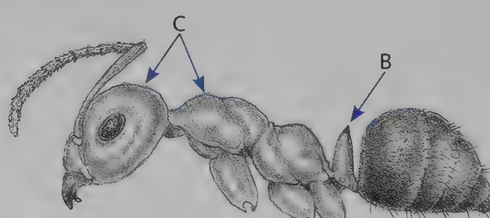
The Slaveless Ant

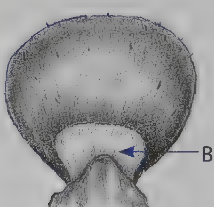
Refers to the fact that it ought to have slaves but may not: *a-* (Gk: without) + *serva* (Lat: slaves).



Habitat: Deep woods, open woods, open fields; nests in soil, under rotten logs or rocks.
Geographic range: Throughout Canada and New England and at high elevations in the Appalachian Mountains, the Rocky Mountains, the Cascade Range.
Natural history: A slave-maker that raids nests of free-living ants of many different *Formica* species, it carries off the larvae and pupae and brings them back to work in its nest. However, many *F. aserva* nests have no slaves; hence its unusual name. When he described the species, Auguste-Henri Forel asked, "Pourquoi n'y avait-il pas d'esclaves?" (Why are there no slaves?).
Look-alikes: *Formica rubicunda, F. subintegra;* petiole shape and body pilosity distinguish them.





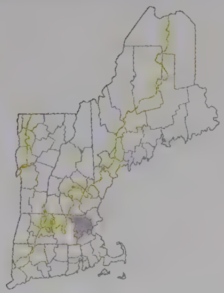


Distinguishing features:
A. Clypeus shallowly notched
B. Petiole broad, fan-shaped (cf. other *sanguinea*-group species)
C. No erect hairs below head or atop pronotum

Formica creightoni Buren, 1968

Creighton's Ant

Honors ant taxonomist William Steel Creighton (1902–1973).

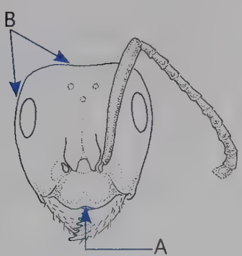


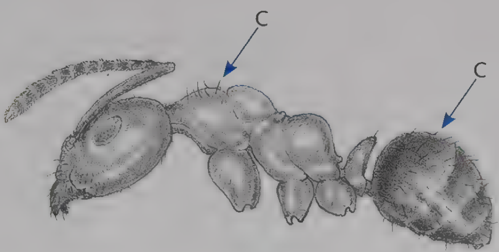
Habitat: Found in open fields, occasionally in forests under logs and in soil.

Geographic range: A Midwestern species; in New England, recorded only from Massachusetts.

Natural history: Enslaves workers in the *Formica neogagates* group.

Look-alikes: *Formica pergandei;* length and density of gastral hairs and face length-to-width ratio distinguish them.





Distinguishing features:

A. Shallowly notched clypeus (cf. *F. pergandei*)

B. Head notably longer than wide (cf. *F. pergandei*)

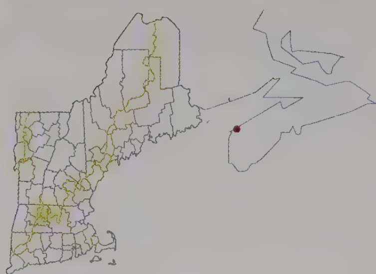
C. Erect promesonotal and gastral hairs sparse, long, tapering

Formica

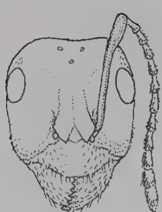
Formica dakotensis Emery, 1893

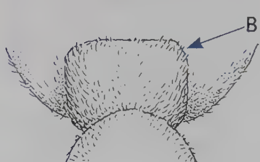
The Dakota Ant

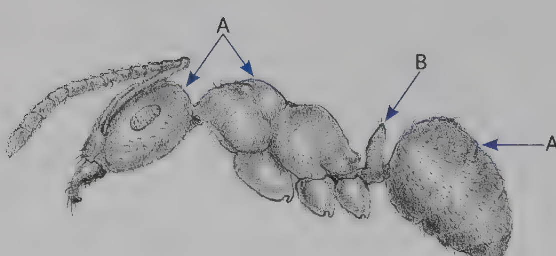
Refers to its type locality, Hill City, South Dakota.



Habitat: Nests around the roots of grassland plants. Plant thatch or debris covers its nests.
Geographic range: In Canada: Nova Scotia west to British Columbia. In the United States: Midwest south to Ohio, Indiana, Iowa; Rocky Mountains south into New Mexico. No known New England records, but recorded from nearby Digby, Nova Scotia, and southern Quebec. Look for this grassland species in Maine!
Natural history: A rarely collected grassland and Great Plains species thought to be an inquiline social parasite of *Formica fusca*– and *pallidefulva*–group species. We follow Creighton in placing *F. dakotensis* in the *rufa* group, but it has very small queens and clavate or spatulate hairs on its pronotum. These characters suggest that it would be better placed in the *microgyna* group.
Look-alikes: Unmistakable; its square-top petiole is unique.





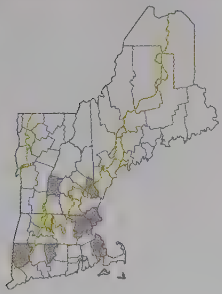


Distinguishing features:
A. Bicolored: head and mesosoma yellowish-red or red; gaster dark
B. Petiole flat topped and square sided

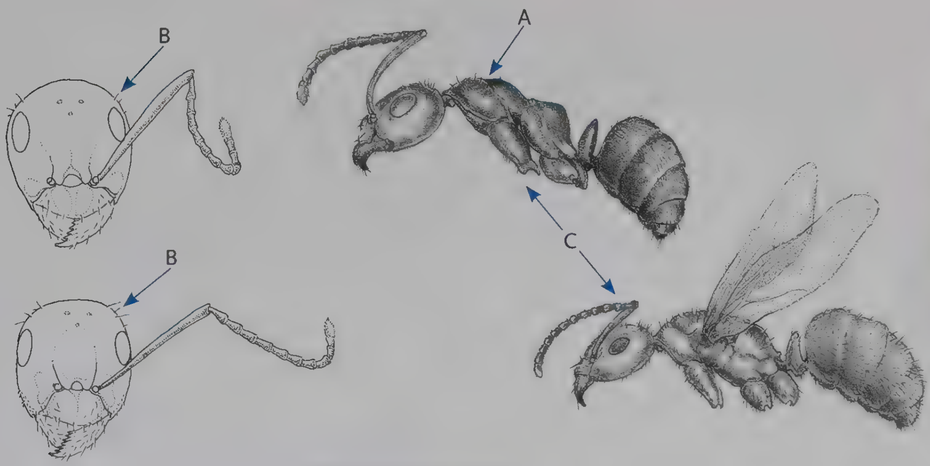
Formica difficilis Emery, 1893

The Troublesome Ant

Refers to the difficulty in identifying it: *difficilis* (Lat: troublesome or causing difficulty).



Habitat: Nests in soil or under dead wood or detritus in dry open fields and open woodlands; nests cryptic, lightly thatched with plant debris.
Geographic range: Massachusetts south to Georgia; west to Iowa.
Natural history: This species collects honeydew from aphids and scale insects and fat-rich elaiosomes from the seeds of sedges (*Carex* species). It is a temporary social parasite of species in the *Formica pallidefulva* group. It establishes new colonies by fission—splitting one colony into two.
Look-alikes: *Formica rufa*– and *microgyna*–group species; note the erect hairs on the corner of its head, only two rows of erect hairs on its middle and hind tibiae, and its small yellow queens.



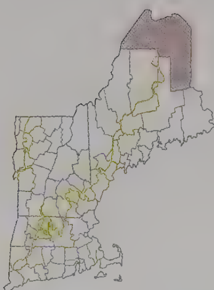
Distinguishing features:

A. Promesonotum has few to many scattered hairs.
B. Erect hairs are present on corners of head (cf. *F. querquetulana*).
C. Queens are yellow, workers bicolored.

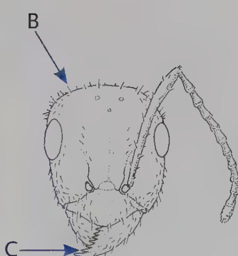
Formica dirksi Wing, 1949

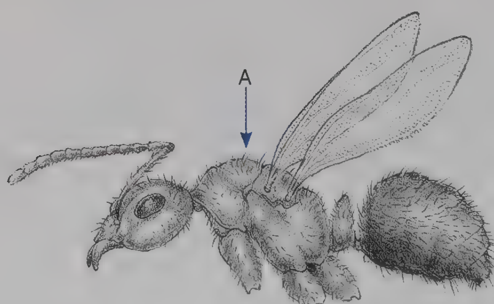
Dirks's Ant

Honors University of Maine entomology professor Charles O. Dirks.



Habitat: The only record of this species is from a nest under loose bark in the wood of a dying, decaying tree stump on the edge of a small clearing in a boreal coniferous forest.
Geographic range: Described and known only from a single queen collected in Daigle, between Fort Kent and Presque Isle, Maine, in 1946.
Natural history: Type specimen collected from a *F. subaenescens* colony; *F. dirksi* is hypothesized to be a temporary social parasite of *F. subaenescens*.
Look-alikes: *Formica impexa;* number of mandibular teeth and erect hairs on corner of head distinguish it. Applies only to queens; workers of *F. dirksi* unknown.



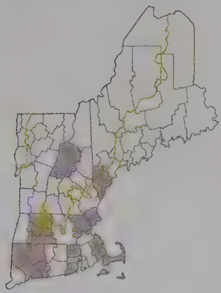


Distinguishing features:
A. Body with many erect hairs
B. Erect hairs on corners of head (cf. *F. impexa*)
C. Mandibles of queen with seven teeth (cf. *F. impexa*)

Formica dolosa Buren, 1944

The Sly Ant

Refers to its behavior when disturbed: *dolosus* (Lat: cunning or sly).

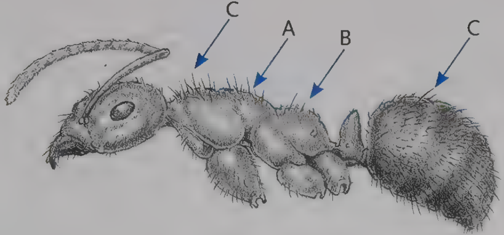


Habitat: Pine barrens, open fields, open woodlands underlain by poor, well-drained, acidic soils.

Geographic range: Southern New England south to Florida, Texas; west to Wisconsin.

Natural history: Only recently distinguished from *F. incerta*, *F. dolosa* is little known. It is enslaved by *Polyergus* cf. *longicornis*.

Look-alikes: *Formica incerta;* propodeal hairs, gastral pubescence, body size distinguish them.



Distinguishing features:

A. Top of propodeum rounded in profile

B. Pronounced brush of dense, erect hairs on propodeum (cf. *F. incerta*)

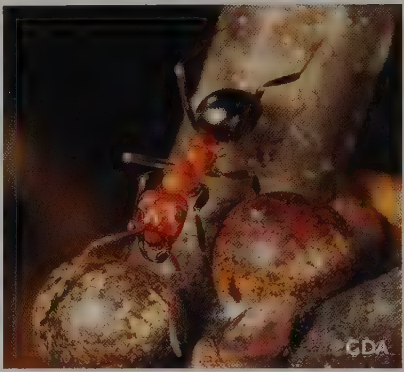
C. Erect promesonotal and gastral hairs long, tapering, dense

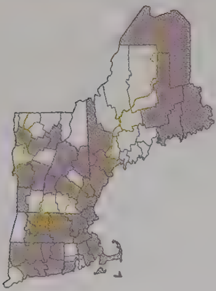
Formica

Formica exsectoides Forel, 1886

*The Allegheny Mound Ant

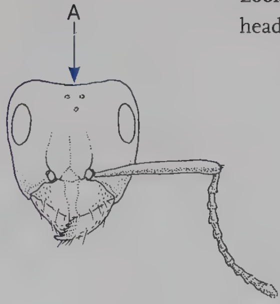
Refers to its concave head, similar to that of the European *Formica exsecta*: *exsecta* (Lat: cut out) + *–oides* (Gk: resembling).

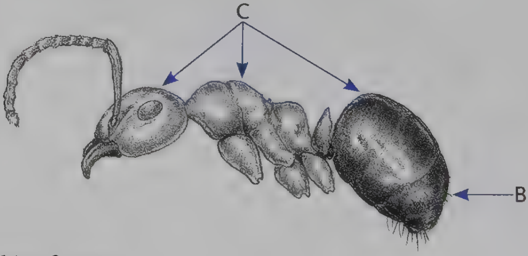




Habitat: Open areas and edges of woods.
Geographic range: Nova Scotia, Ontario; throughout New England; south to Georgia; west to Colorado, New Mexico.
Natural history: Forms huge polydomous colonies of dozens of mounds 1–2 m high. A temporary social parasite of *F. subsericea* and other *fusca*-group species, its colonies reproduce mainly by fission. Workers are aggressive predators; they tend aphids, scale insects, and tree-hoppers for honeydew and collect plant sap and nectar. Nest-dwelling myrmecophiles include beetles, flies, and larvae of Edward's Hairstreak (*Satyrium edwardsii*), which, like some other "blues" (Lycaenidae butterflies), have caterpillars that live in ant nests. The ants protect these caterpillars from predators; the caterpillars feed the ants with a sugar-rich fluid secreted by a special nectary organ near the end of the back. Larvae of the predaceous syrphid fly, *Microdon abstrusus*, live in the top of *F. exsectoides* mounds; these fly larvae eat the ant brood. Adult *Microdon* emerge and mate just outside the nest mounds.
Look-alikes: *Formica sanguinea*–group species; the concave top of the head distinguishes *F. exsectoides*, which also lacks a clypeal notch.

Formica



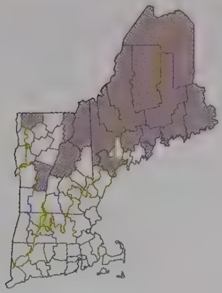


Distinguishing features:
A. Top of head concave (cf. *F. rufa* and *microgyna* groups)
B. Erect hairs only on the back end of the gaster (cf. *F. ulkei*)
C. Bicolored: head and mesosoma red to yellow, gaster dark

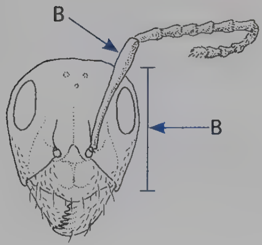
Formica glacialis Wheeler, 1908

The Icy Ant

Refers to its life in boreal regions: *glacies* (Lat: ice).



Habitat: Open fields and early successional shrublands.
Geographic range: Newfoundland to Saskatchewan in formerly glaciated regions between 40° and 50° North latitude. In New England, most common in northern New Hampshire and Maine.
Natural history: Forms large colonies in small mound nests made of soil, covered with living vegetation. The temporary social parasite *F. ulkei* may co-opt its colonies.
Look-alikes: *Formica fusca*–group species; scape length, silvery gastral pubescence, pilosity, and nest-type distinguish them.

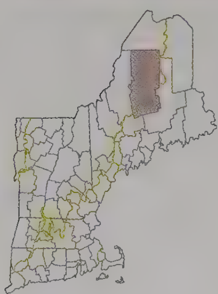


Distinguishing features:
A. Silvery pubescence on gastral tergites 1–2 (cf. *F. podzolica*)
B. Scapes shorter than head length (cf. *F. subsericea*)
C. Many erect hairs on the gaster (cf. *F. subaenescens*)

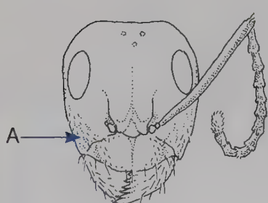
Formica hewitti Wheeler, 1917

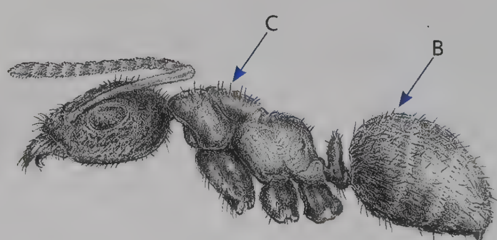
Hewitt's Ant

Honors Canadian entomologist Charles Gordon Hewitt (1885–1920).



Habitat: Boreal coniferous forests; nests in soil, under rocks and logs.
Geographic range: Across Canada; south into the western United States at high elevations. In New England, recorded only near Moosehead Lake (Maine).
Natural history: An omnivorous feeder, it preys on small insects, scavenges carcasses, tends aphids and scale insects.
Look-alikes: *Formica neorufibarbis:* color and pilosity distinguish them.



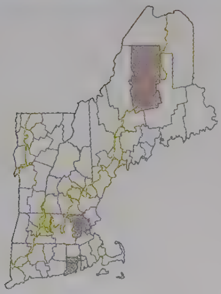


Distinguishing features:
A. Distinctive punctures on its hairy cheeks
B. Silver pubescence only on gastral tergite 1 (cf. *F. neorufibarbis*)
C. Body with many long, erect hairs (cf. *F. neorufibarbis*)

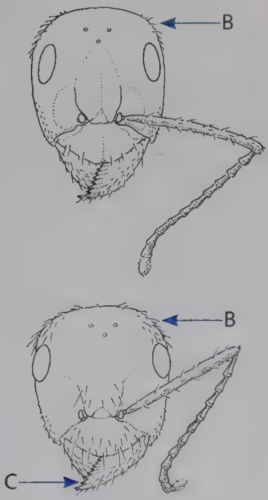
Formica impexa Wheeler, 1905

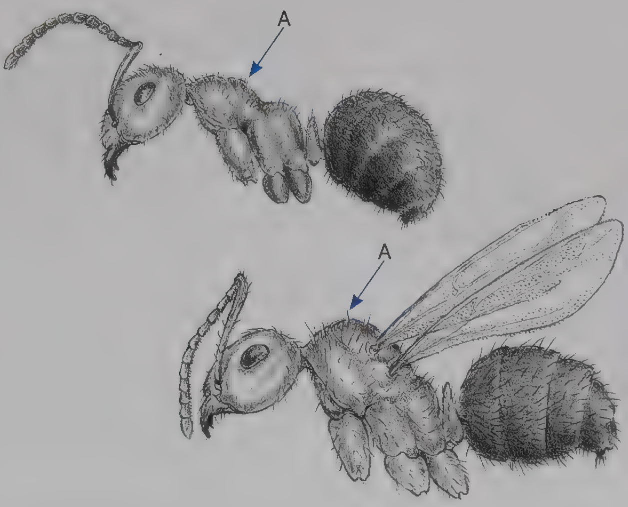
The Unkempt Ant

Refers to its hairiness: *im-* (Lat: not) + *pexa* (Lat: combed).



Habitat: Nests under stones and logs in open coniferous forests underlain by sandy soils.
Geographic range: Unknown. Collected in Maine, Massachusetts, New York, Quebec, Michigan, Wisconsin.
Natural history: Rarely collected; unstudied in the field.
Look-alikes: *Formica dirksi, F. nepticula;* 8 mandibular teeth eliminate *F. dirksi;* long erect hairs and dense gastral pubescence eliminate *F. nepticula;* whitish or pale yellow erect hairs on legs unique to *F. impexa.*



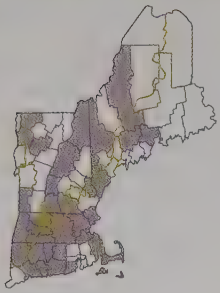


Distinguishing features:
A. Body very hairy (cf. *F. nepticula*)
B. Erect hairs at corners of head flattened (cf. *F. dirski*)
C. Eight teeth on mandibles of queen (cf. *F. dirksi*)

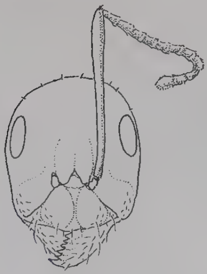
Formica incerta Buren, 1944

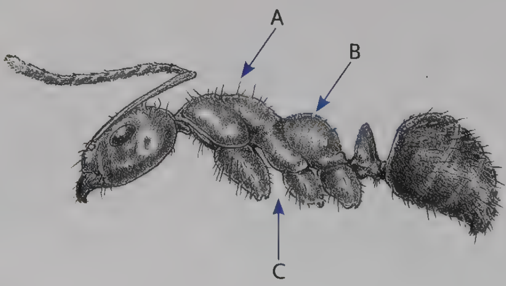
The Uncertain Ant

Refers to its uncertain taxonomic status: *incerta* (Lat: uncertain).



Habitat: Open areas: moist grasslands, old fields, lawns, gardens, power line rights-of-way.
Geographic range: Southern New England; south into the Appalachian Mountains; west to Minnesota, Colorado.
Natural history: Enslaved by *F. pergandei* and *Polyergus lucidus*.
Look-alikes: *Formica pallidefulva*–group species; pilosity and size separate the three species in this group.



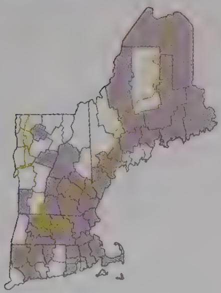


Distinguishing features:
A. Sparse hairs on the promesonotum (cf. *F. dolosa*)
B. Few, short hairs on propodeum (cf. *F. dolosa*)
C. Light body color; may appear bicolored (cf. *F. pallidefulva*)

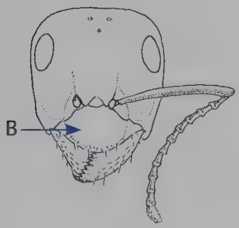
Formica integra Nylander, 1856

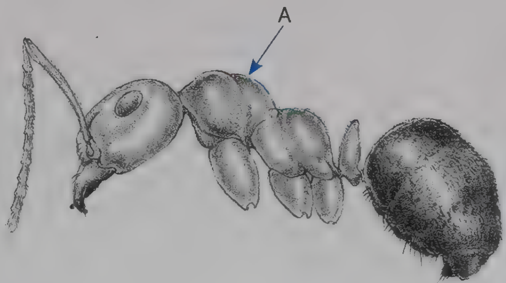
The Complete Ant

Refers to its unnotched clypeus: *integra* (Lat: complete).



Habitat: Nests in rotten stumps and logs and under rocks along forest edges, in open woodlands and old fields; rare in grasslands. Piles sand or other debris atop its nest.
Geographic range: Nova Scotia, Quebec; throughout New England; south to Mississippi.
Natural history: Individual colonies large but not polydomous. Workers collect honeydew and disperse seeds of violets (*Viola* species) after eating the protein- and fat-rich elaiosomes that attract it to the seeds.
Look-alikes: *Formica* cf. *fossaceps;* the smooth shape of the clypeus identifies *F. integra*.



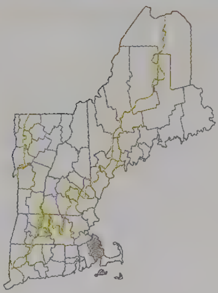


Distinguishing features:
A. Ant nearly hairless
B. Middle of clypeus drops smoothly and evenly to the sides (cf. *F. obscuriventris, F.* cf. *fossaceps*).

Formica knighti Buren, 1944

Knight's Ant

Honors Iowa State College entomology professor Harry Hazelton Knight (1889–1976).

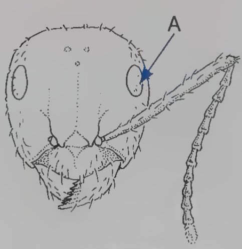


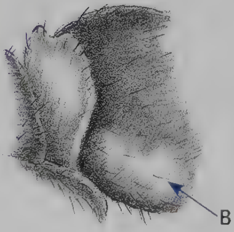
Habitat: Pine barrens in New England; makes cryptic nests out of plant debris under mats of Bearberry (*Arctostaphylos uva-ursi*).

Geographic range: Midwestern prairies; collected in New England only from sandy pine barrens in Massachusetts.

Natural history: Rarely collected, it makes large colonies (>10,000 workers) and is hypothesized to be a temporary social parasite of *Formica subsericea*.

Look-alikes: Unmistakable; the combination of hairy compound eyes, copper-colored hairs on its body, and a yellow splash on the anterior surface of its gaster is unique among New England ants.





Distinguishing features:

A. Erect hairs project out between ommatidia.

B. Splash of yellow on anterior face of gaster is unique.

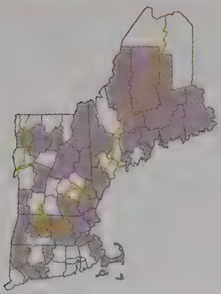
C. Erect hairs on body are copper colored.

Formica

Formica lasioides Emery, 1893

The Fuzzy *Formica*

Refers to *Lasius niger*, the European Black Fuzzy Ant: *lasios* (Gk: hairy, fuzzy) + *-oides* (Gk: resembling).

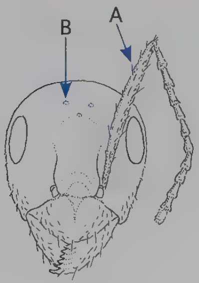


Habitat: Open fields; makes inconspicuous nests in soil or under small rocks and grass clumps.

Geographic range: Throughout northern North America and Canada.

Natural history: Enslaved by *Formica pergandei* and *F. creightoni*.

Look-alikes: *Formica neogagates, Prenolepis imparis;* habitat and scape hairs distinguish the two *Formica* species; presence of ocelli and robust mesosoma eliminates *P. imparis*.



Formica

Distinguishing features:

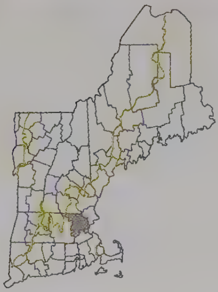
A. Scape with at least 3 erect hairs (cf. *F. neogagates*)

B. Ocelli apparent (cf. *Prenolepis imparis*)

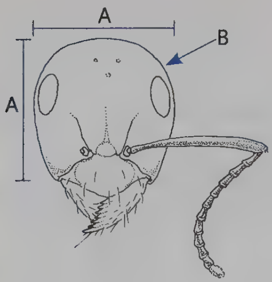
Formica morsei Wheeler, 1906

Morse's Ant

Honors its collector, Albert Pitts Morse (1863–1936).



Habitat: Unknown.
Geographic range: Unknown. So far collected only one September in the early 1900s from a single "flourishing colony in South Natick, Massachusetts." Look for it in the woods of Massachusetts!
Natural history: No data available.
Look-alikes: *Formica rufa*– and *microgyna*–group species; because only workers were collected, its placement in the *microgyna* group is based on its blunt erect hairs. *Formica morsei* is distinguished by its relatively long, convex, rounded head; a single row of white hairs on each tibia; and short, sparse, white pubescence on its body. most visible on its gaster.



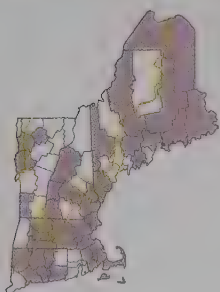
Distinguishing features:
A. Head (excluding mandibles) notably longer than broad
B. Top of head convex, rounded
C. Sparse white pubescence visible on gaster

Formica

Formica neogagates Viereck, 1903

The New World Black Ant

Refers to its similarity to the European *Formica gagates: neo-* (Gk: new [New World]) + *gagates* (Gk: jet, as in jet black).

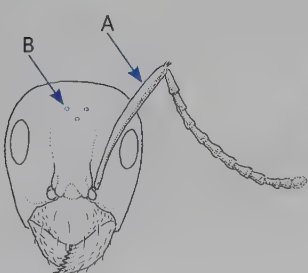


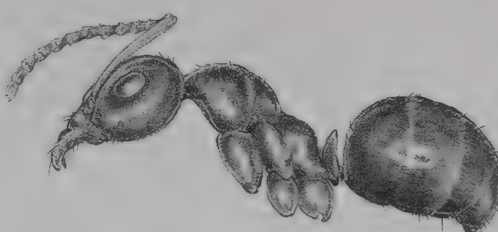
Habitat: Nests in soil or under small rocks in rich moist woods.

Geographic range: North America and eastern Canada; throughout New England.

Natural history: A common woodland ant with small colonies (<500 workers). Tends scale insects and aphids for honeydew and forages for sugar at extrafloral nectaries of Bigtooth Aspen (*Populus grandidentata*). Enslaved by *F. pergandei* and *F. creightoni*.

Look-alikes: *Formica lasioides, Prenolepis imparis;* habitat and scape hairs distinguish the two *Formica* species; presence of ocelli and robust mesosoma eliminates *P. imparis*.





Distinguishing features:

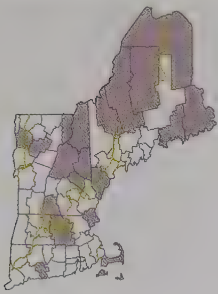
A. Scapes usually with no, but always ≤ 2, erect hairs (cf. *F. lasioides*)

B. Ocelli apparent (cf. *Prenolepis imparis*)

Formica neorufibarbis Emery, 1893

The New World Red-bearded Ant

Refers to its red cheeks: *neo-* (Gk: new [New World] + *rufus* (Lat: red) + *barba* (Lat: beard, hair).

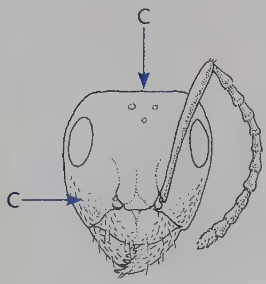


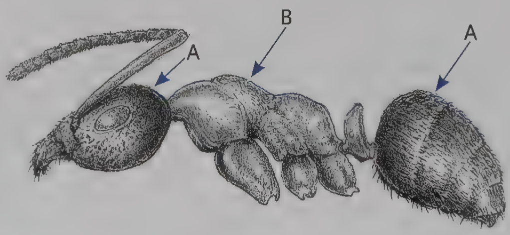
Habitat: Nests in dead wood and under rocks, in *Sphagnum* moss in peatlands.

Geographic range: Across North America: Alaska south to Arizona; east to Newfoundland. Widespread in New England.

Natural history: One of the most cold-tolerant ants in North America, it is found up to the edge of the taiga in northern Canada. Occasionally enslaved by *F. aserva*.

Look-alikes: *Formica hewitti, F. ulkei*. Red color on the body and few hairs eliminate *F. hewitti;* a flat-topped head identifies *F. neorufibarbis*, which is also free-living, unlike the concave-headed, socially parasitic *F. ulkei*.





Distinguishing features:

A. Bicolored: head and gaster dark, mesosoma dark red

B. Faint silvery pubescence, few erect hairs (cf. *F. hewitti*)

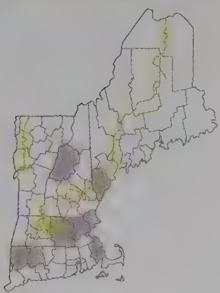
C. Head flat; hairy cheeks with elongate punctures (cf. *F. ulkei*)

Formica

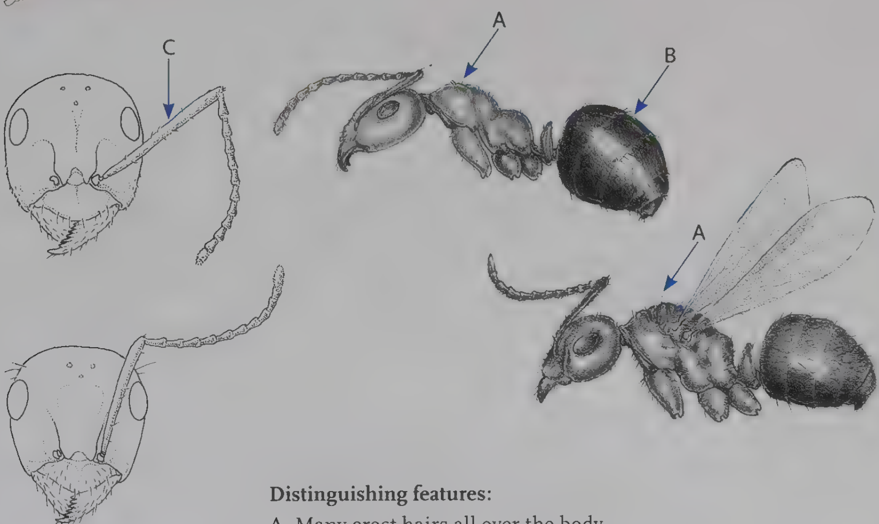
Formica nepticula Wheeler, 1905

The Little Ant

Refers to its size: *nepticula* (Lat: diminutive form of *neptis*, meaning granddaughter or niece).



Habitat: Pine barrens, open woodlands, old fields, power line rights-of-way; nests in soil, under wood and stones.
Geographic range: Unknown. Collected in Quebec, Maine, Massachusetts, Connecticut, Michigan, Illinois, Iowa.
Natural history: A temporary social parasite on *fusca-* and *neogagates-*group species.
Look-alikes: *Formica impexa;* sparse erect hairs, pubescence, and small, usually entirely brown, queens identify *F. nepticula*.



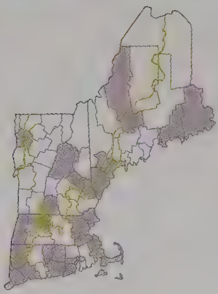
Distinguishing features:
A. Many erect hairs all over the body
B. Gaster shiny with short hairs (cf. *F. impexa*)
C. Many erect hairs on scape

Formica

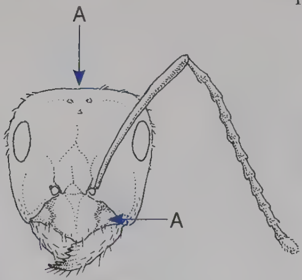
Formica obscuriventris Mayr, 1870

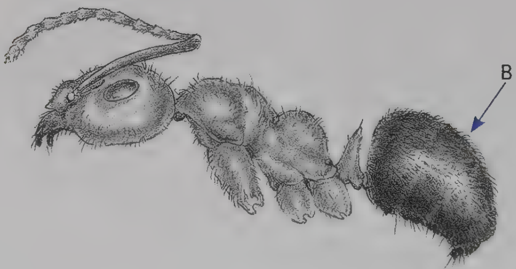
The Dark-bellied Ant

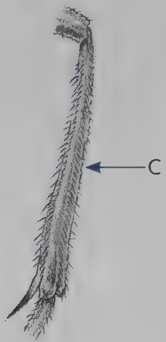
Refers to its dark gaster: *obscurus* (Lat: dark) + *ventris* (Lat: belly).



Habitat: Open woodlands and forest edges; nests in stumps and soil, under logs and trash. Nests are often thatched with plant litter.
Geographic range: Quebec and Maine south to Virginia; west to the prairies of North Dakota, Iowa; into Colorado, Nevada. Widespread but sparse in New England.
Natural history: An aggressive species that forms large colonies (>10,000 workers) and maintains long columns of foragers. Omnivorously preys on small insects, scavenges dead insects, and feeds on honeydew secreted by aphids, scales, and treehoppers.
Look-alikes: *Formica integra, F. reflexa, F.* cf. *fossaceps;* clypeal shape and pilosity on body and legs distinguish them.







Distinguishing features:

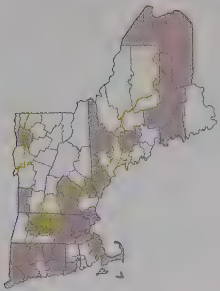
A. Head very square; clypeus pinched at corners (cf. *F. integra*)
B. Erect hairs on gaster straight and sharp (cf. *F. reflexa*)
C. Middle and hind tibiae with many rows of erect hairs (cf. *F.* cf. *fossaceps*)

Formica

Formica pallidefulva Latreille, 1802

The Pale Ant

Refers to its color: *pallidus* (Lat: pale) + *fulvus* (Lat: reddish-yellow).

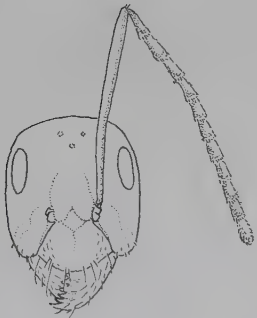


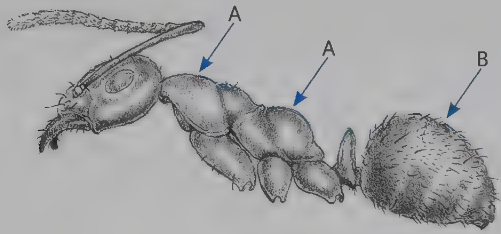
Habitat: Open woodlands, fields, lawns; nests in rotten logs, under bark, tree branches, grass clumps.

Geographic range: Eastern United States, southern Canada, the Great Plains, low-elevation sites in the western United States. Widespread in New England.

Natural history: Gathers honeydew deposited on leaves by aphids and scale insects, but does not actively tend them. Frequently a slave of *F. pergandei* and *Polyergus montivagus*. Adults of the scarab beetle *Cremastocheilus castaneus* sometimes live in *F. pallidefulva* nests, feeding on ant brood.

Look-alikes: *Formica dolosa, F. incerta;* pilosity and habitat distinguish them. In New England, *F. pallidefulva* is often light brown, but color is not usually reliable here.





Distinguishing features:

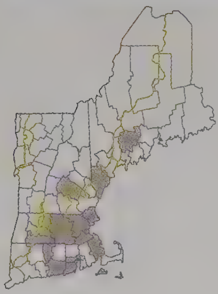
A. No hairs (cf. *F. incerta*) on promesonotum or propodeum

B. Erect hairs on gaster short (cf. *F. dolosa*)

Formica pergandei Emery, 1893

Pergande's Ant

Honors ant systematist Theodore Pergande (1840–1916).

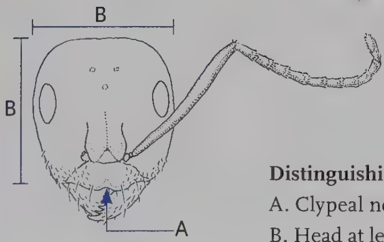


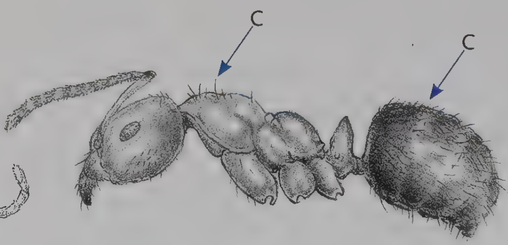
Habitat: Open habitats and forest edges; nests under rotten logs and in well-drained, sandy soil.

Geographic range: Northeastern and north central United States; north into Quebec.

Natural history: Enslaves many *Formica* species, especially in the *pallidefulva* group, but also *F. subsericea, F. querquetulana, F. neogagates, F. difficilis.*

Look-alikes: *F. creightoni;* length and density of promesonotal and gastral hairs and head length-to-width ratio distinguish them.





Distinguishing features:

A. Clypeal notch deep (cf. *F. aserva, F. creightoni*)

B. Head at least as wide as long (cf. *F. creightoni*)

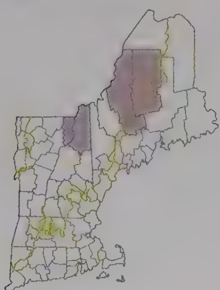
C. Erect promesonotal and gastral hairs long, tapering, dense

Formica

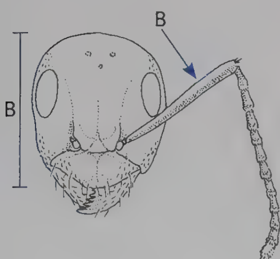
Formica podzolica Francoeur, 1973

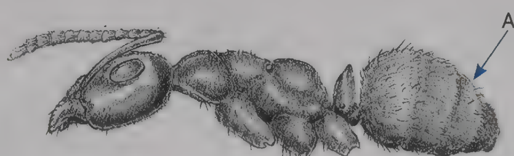
The Podzol Ant

Refers to the soil in which it nests: *podzol* (Russian: a type of soil).



Habitat: Nests in the acidic, infertile podzolic soils of cold evergreen conifer forests.
Geographic range: Across northern North America, Nova Scotia to Alaska; across the northern United States south into the mountains of Pennsylvania. In New England, recorded only from northern New Hampshire and Maine.
Natural history: Makes large mound nests, but is rarely studied.
Look-alikes: *Formica fusca*–group species; scape length, silvery gastral pubescence, pilosity, and nest type distinguish them.





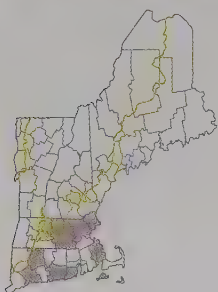
Distinguishing features:
A. Silvery pubescence on gastral tergites 1–3 (cf. *F. glacialis*)
B. Scapes shorter than head length (cf. *F. subsericea*)

Formica querquetulana

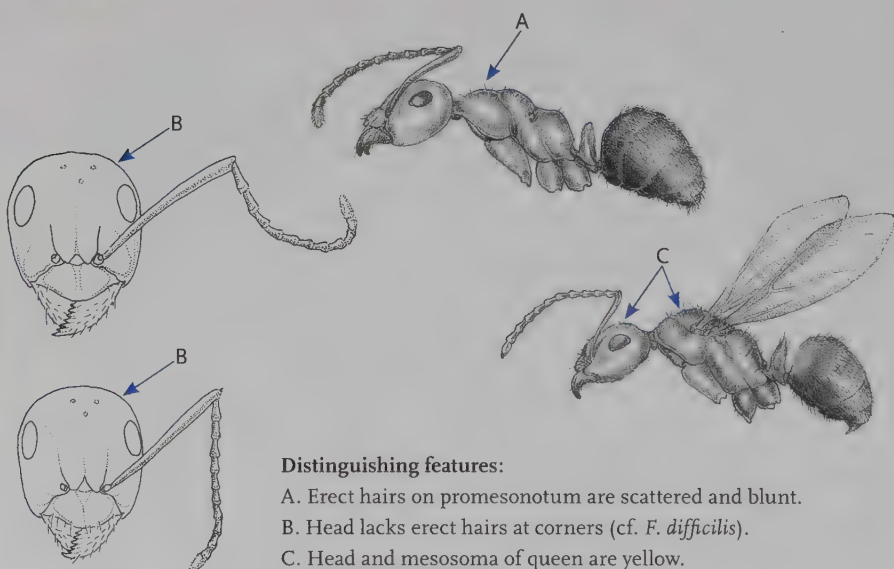
Kennedy and Dennis, 1937

The Oak-grove Ant

Refers to its type habitat: *querquetum* (Lat: oak forest).



Habitat: Very dry, sandy soils in oak woodlands, open pine barrens, shrublands. Nests under leaves, rocks, other debris.
Geographic range: New England to the Midwestern states.
Natural history: One of the most commonly collected *F. microgyna*–group species in New England. Forms polygynous colonies of 1,000–5,000 workers. A temporary social parasite of *pallidefulva*-group species. Queens and males are produced late June–early July.
Look-alikes: *Formica difficilis; F. querquetulana* lacks erect hairs at the corners of its head.



Distinguishing features:

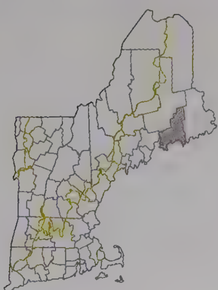
A. Erect hairs on promesonotum are scattered and blunt.
B. Head lacks erect hairs at corners (cf. *F. difficilis*).
C. Head and mesosoma of queen are yellow.

Formica

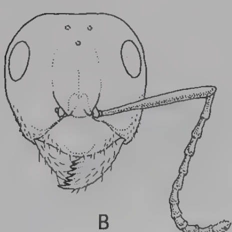
Formica reflexa Buren, 1942

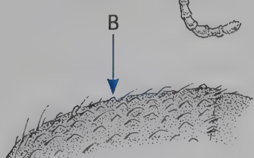
The Bent-haired Ant

Refers to the hairs on its gaster: *reflexus* (Lat: bent or turned back).



Habitat: Open fields, woodlands, wetland edges, and forests.
Geographic range: Upper Midwestern United States. Only one New England record, from an open field in Maine's Acadia National Park (2003).
Natural history: Poorly studied, but thought to be an inquiline social parasite, but not a slave-maker, of *F. subsericea*.
Look-alikes: Unmistakable; its strongly reflexed gastral hairs, which appear as little loops at 25–50× magnification, are unique.



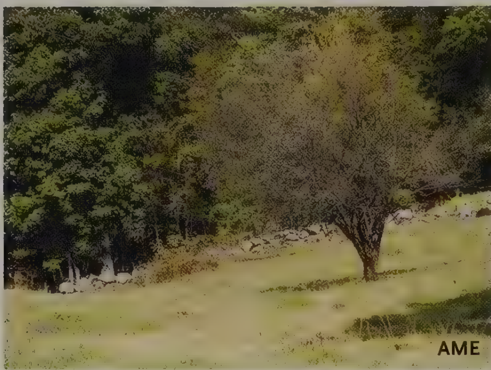


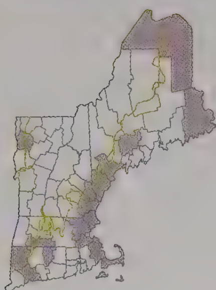
Distinguishing features:
A. Body hairy, gaster shining
B. Erect hairs on gaster bent and reflexed, appearing as little loops at 25–50× (cf. *F. obscuriventris*)

Formica rubicunda Emery, 1893

The Ruddy Slave-making Ant

Refers to its color: *rubicundus* (Lat: ruddy, reddish, red).



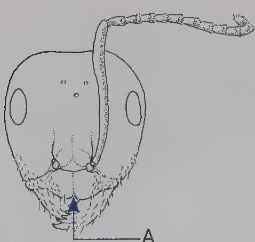


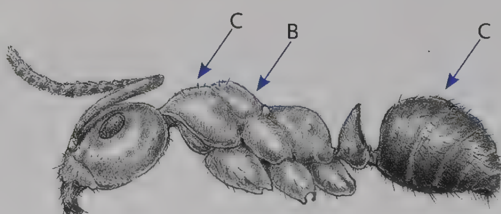
Habitat: Nests in soil or under rocks in many open habitats. Its small mound nests are often topped with gravel or other debris.

Geographic range: Quebec and Ontario south to the Carolinas; west to Montana, New Mexico. In New England, predominantly on the coastal plain: Down East Maine to southern Rhode Island.

Natural history: Enslaves *Formica fusca*–group species.

Look-alikes: *Formica pergandei, F. subintegra:* promesonotal hair length and density, body color, and especially mesosomal profile distinguish these species.





Distinguishing features:

A. Clypeal notch deep (cf. *F. subintegra*)

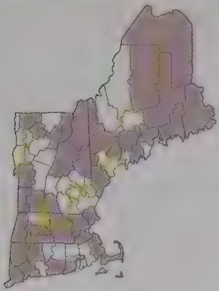
B. Mesosoma curved in profile (cf. *F. subintegra*)

C. Hairs on promesonotum and gaster short, bristly (cf. *F. pergandei*)

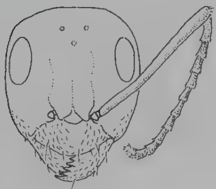
Formica subaenescens Emery, 1893

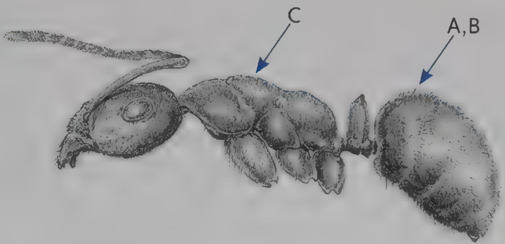
The Light Bronze Ant

Refers to its color: *sub-* (Lat: less than) + *aenum* (Lat: bronze).



Habitat: Moist woodlands; nests in soil, under rocks, in dead wood, in drier *Sphagnum* hummocks in bogs and nutrient-poor fens.
Geographic range: Minnesota east to Labrador; south into Pennsylvania.
Natural history: A common prey of the pitcher plant *Sarracenia purpurea* in bogs. Can be very aggressive when its cryptic *Sphagnum* nests are disturbed.
Look-alikes: *Formica fusca*–group species; scape length, silvery gastral pubescence, pilosity, and nest type distinguish them.



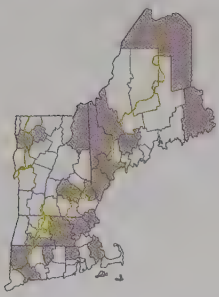


Distinguishing features:
A. Silvery pubescence on gastral tergite 1 (cf. *F. subsericea*)
B. Fewer than 10 erect hairs on gastral tergite 1 (cf. *F. subsericea*)
C. Brown to dark brown color

Formica subintegra Wheeler, 1908

The Incomplete Ant

Refers to its incomplete (i.e., notched) clypeus: *sub-* (Lat: less than) + *integra* (Lat: complete).

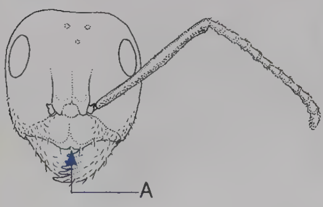


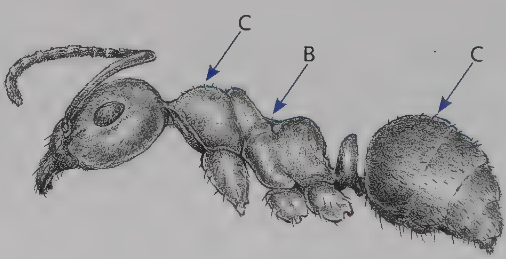
Habitat: Makes low, spreading nests in soil and under rocks in relatively open habitats.

Geographic range: Newfoundland and Ontario south to the Carolinas; west to the Dakotas and Alberta.

Natural history: Enslaves *F. fusca*–group species.

Look-alikes: *Formica pergandei, F. rubicunda:* promesonotal hair length and density, body color, and especially mesosomal profile distinguish these species.





Distinguishing features:

A. Clypeal notch shallow (cf. *F. rubicunda*)

B. Mesosoma in profile saddle shaped (cf. *F. rubicunda*)

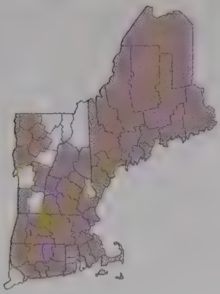
C. Hairs on promesonotum and gaster short, bristly (cf. *F. pergandei*)

Formica

Formica subsericea Say, 1836

The Somewhat Silky Ant

Refers to its silvery hairs: *sub-* (Lat: less than) + *sericus* (Lat: silk).



Habitat: Open deciduous forests, pine barrens, old fields, roadsides, lawns and gardens. Nests often flat, sloppy disks of excavated soil with many entrances; when taken over by *F. exsectoides*, nests are often enlarged to mounds that exceed 1 m^3 in volume.

Geographic range: New Brunswick south to Mississippi; west to Montana. The most frequently collected *fusca*-group species in southern New England.

Natural history: Often tends treehoppers for honeydew. Socially parasitized by *F. exsectoides;* enslaved by *F. subintegra, F. rubicunda, F. pergandei;* and parasitized by the syrphid fly *Microdon megalogaster.* Males have distinctive yellow-orange legs.

Look-alikes: *Formica fusca*–group species; scape length, silvery gastral pubescence, pilosity, and nest type distinguish them.

Formica

Distinguishing features:

A. Antennal scapes longer than head length (cf. *F. podzolica*)

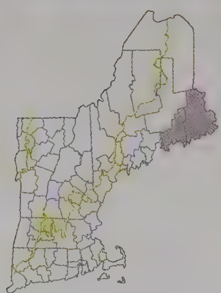
B. Silvery pubescence on gastral segments 1–3 (cf. *F. argentea*)

C. Many erect hairs on promesonotum and gaster (cf. *F. subaenescens*)

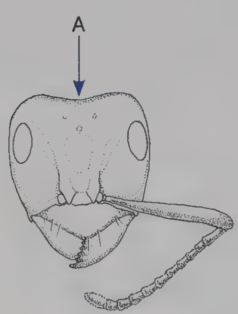
Formica ulkei Emery, 1893

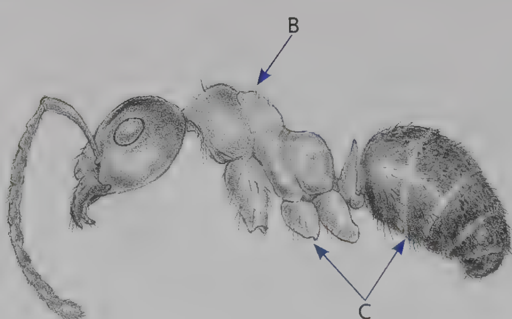
Ulke's Ant

Honors mineralogist and insect collector Titus Ulke (1866–1961).



Habitat: Makes conical mound nests (≤0.5 m tall) thatched with dried grass in open habitats.
Geographic range: Nova Scotia, Quebec, Manitoba, upper Midwestern United States. In New England, so far recorded only from Down East Maine.
Natural history: A prairie species, often polygynous and polydomous, it is a temporary social parasite of *F. glacialis*. Tends aphids, scale insects, treehoppers for honeydew. The myrmecophilous rove beetle *Megastilicus formicarius* lives in its mound nests, scavenging for food.
Look-alikes: *Formica exsectoides, F. neorufibarbis;* the concave head and mound nests eliminate *F. neorufibarbis,* and many erect hairs eliminate *F. exsectoides.*

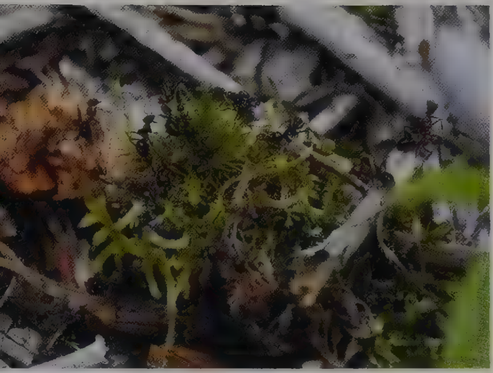


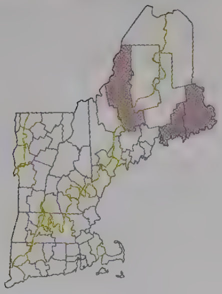


Distinguishing features:
A. Top of head concave (cf. *F. neorufibarbis*)
B. Many erect hairs on body (cf. *F. exsectoides*)
C. Bicolored: head and gaster dark, mesosoma red

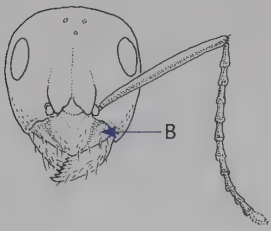
Formica

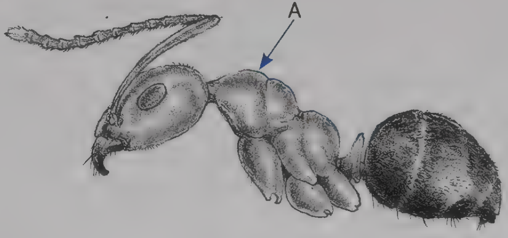
An undescribed species of *Formica* that is closely related to *Formica fossaceps*





Habitat: Blueberry barrens and woodland edges.
Geographic range: Unknown. Collected so far from Down East Maine and Prince Edward Island.
Natural history: Unstudied. Its namesake makes small mound-shaped nests using leaf litter and other plant parts, and maintains extensive foraging trails.
Look-alikes: *Formica integra, F. obscuriventris;* hairlessness eliminates *F. obscuriventris*. The pinched clypeus of *F.* cf. *fossaceps* is distinctive and is the origin of the name *fossaceps*—from the Latin *fossatus*, meaning dug, + the combination form *-ceps*, referring to its head.





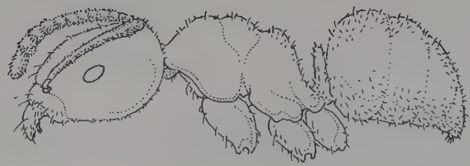
Distinguishing features:
A. Body nearly hairless (cf. *F. obscuriventris*)
B. Sides of the clypeus pinched (cf. *F. integra*)

Formica

Lasius Fabricius, 1804

The Fuzzy Ants

From the Greek *lasios*, meaning woolly or hairy



Ants in the genus *Lasius* are some of the most frequently encountered in New England. These small, yellow-to-brown ants are abundant in fields, forests, wetlands, and uplands throughout the temperate regions of the Northern Hemisphere. Nearly 150 species of *Lasius* have been described, but for almost 150 years after the genus was first proposed by Johann Christian Fabricius in 1804, there was a great deal of controversy—not only over which species belonged in *Lasius*, but also whether the name *Lasius* could even be used for this group of ants. The controversy arose because three years earlier (in 1801), Louis Jurine had anonymously published a paper in the German literary journal *Intelligenzblatt der Literatur-Zeitung* in which he had used *Lasius* to refer to a new genus of bees. Five years later, but after Fabricius had named a genus of ants *Lasius*, Jurine admitted to having authored the earlier paper. The so-called Jurinean controversy—would *Lasius* be used for ants or bees?—was initially moot, because in 1809 Pierre André Latreille placed all ants in the genus *Lasius* within the larger genus *Formica*. But Gustav Mayr reopened these ancient wounds in 1861 by resuscitating the genus *Lasius*.

The contemporaneous Civil War in the United States lasted only four years, but the Jurinean controversy raged for a much longer time. In 1916, William Morton Wheeler fired this salvo in a short paper in which he attempted to resolve the Jurinean controversy: "There seems to be no end to the nomenclatorial cataclysms precipitated by men who delight in resuscitating and reëditing musty entomological documents that have been unfortunately spared by the tooth of time to plague those among us who wish to see taxonomy rapidly stabilized so that we may be able to give all our attention to more interesting and important matters."

It took another 23 years until the International Commission on Zoological Nomenclature ruled in favor of the ants (in its 1939 Opinion number 135). Nearly two decades later, and over 150 years after *Lasius* had first been described, E. O. Wilson finally provided, in his doctoral dissertation, the foundation for a modern classification of *Lasius* species. All that remained was the question of whether the "citronella ants" belonged in their own genus (*Acanthomyops*) or in *Lasius*. Examination of DNA sequences by Milan Janda and his colleagues in 2004 led to the inescapable conclusion that the citronella ants are *Lasius*, too.

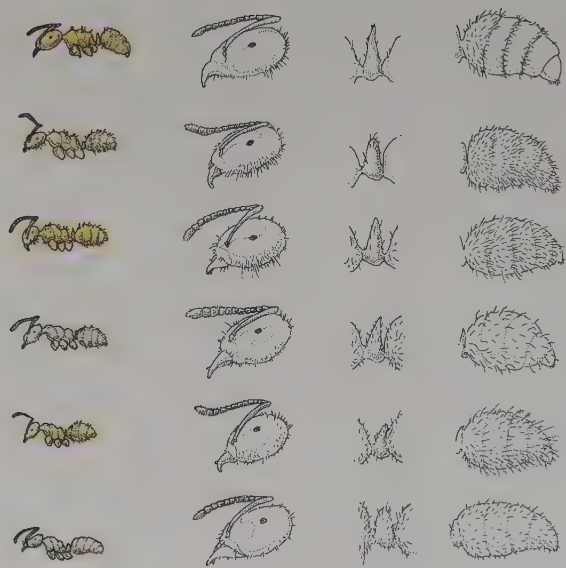
There are now at least 56 species of *Lasius* in North America, 15 of which have been recorded from New England. Two additional species are included in this guide: *L. plumopilosus,* an attractive and unmistakable species recorded so far only as far north as Long Island, and *L. murphyi,* also known from Long Island, which is superficially similar to *L. latipes.* Both are destined to arrive on New England's southern shores.

Identifying the Species of *Lasius*

The New England species of *Lasius* are easily separated into four groups distinguished by the number of segments of the maxillary palps (three in the citronella ants of the *claviger* group and six in the other three groups) and the size of the eyes ("large" in the *niger* group, "medium" in the *umbratus* group, or "small" in the *flavus* group). In earlier taxonomic works, these groups were considered separate subgenera: *Acanthomyops* (now the *claviger* group), *Lasius* (now the *niger* group), *Chthonolasius* (now the *umbratus* group), and *Cautolasius* (now the *flavus* group). Identifying species within each group requires careful attention to microscopic details, especially—and perhaps not surprisingly—characteristics of body hair.

The *claviger* group—This group, in which all the species have three-segmented maxillary palps, can be quickly recognized in the field because the ants are bright yellow to orange and give off a distinctive lemony or citronella odor when they are disturbed. The *claviger*-group species are all warm-temperate species that are more common in Connecticut, Rhode Island, and coastal Massachusetts, New Hampshire, and Maine than in the central and northern interior regions of New England. All of the species of the *claviger* group are believed to be temporary social parasites of other *Lasius* species, but the actual hosts are not all known. Our six species are *L. claviger, L. interjectus, L. latipes, L. murphyi, L. plumopilosus,* and *L. subglaber;* a number of hybrid colonies have been found in nature, but whether they produce fertile queens remains unknown.

Lasius plumopilosus has unique feather-tipped hairs on its gaster. The remaining five species are separated on the basis of the shape of the petiole when viewed from the side and the distribution and length of hairs on the body. Three species, *L. claviger, L. interjectus,* and *L. subglaber,* have petioles that are sharply pointed in profile. Of these three, *L. claviger* has long, erect hairs all over its gaster and long hairs on its cheeks and the underside of its head. *Lasius interjectus* has long erect hairs all over the first segment of its gaster but has hairs only on the edges of the second and third gastral tergites. It also has very few hairs on its cheeks. *Lasius subglaber* has short hairs on its cheeks and fine, short, sparse hairs elsewhere on its body. The last two



***claviger* group**

Lasius interjectus

Lasius latipes

Lasius claviger

Lasius subglaber

Lasius plumopilosus

Lasius murphyi

species in the *claviger* group, *Lasius latipes* and *L. murphyi*, have petioles that are blunt and rounded when viewed in profile. *Lasius latipes* has long hairs all over its body and many long hairs on its cheeks and under its head. In contrast, *L. murphyi* has hairs that are densest on its propodeum and has only a few short hairs on its cheeks.

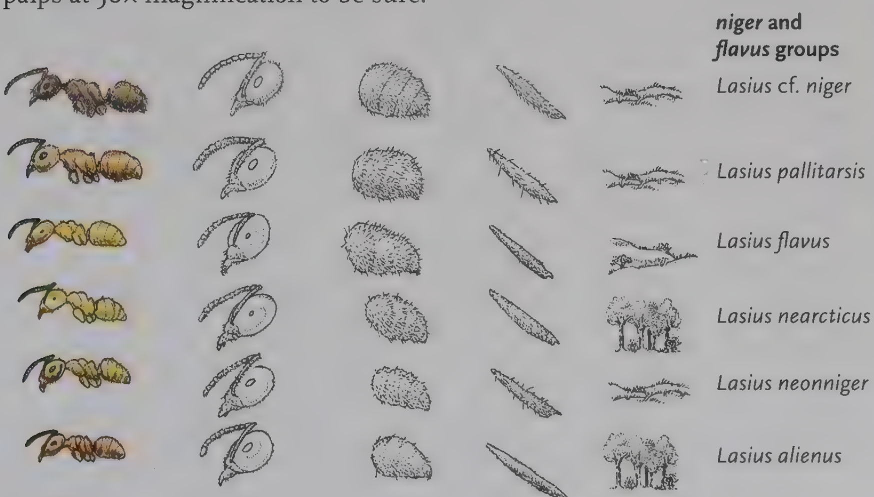
The matrix key above illustrates four morphological characters that can be used to quickly determine which species of the *claviger* group you have. Each species is shown in profile; the size shown is approximately three times the size of a major worker. The principal characteristics to look for on the head in side view are the length and location of hairs on the cheeks and on the underside of the head. Next, determine whether the petiole is sharp and pointed or rounded and blunt in profile. Finally, check the location and density (and, in the case of *L. plumopilosus*, the featheriness) of the hairs on the gaster. The species are ordered from top to bottom by size.

The *niger* group—Among the *Lasius* species with six-segmented palps, the four species of the *niger* group have the largest eyes: their length (top to bottom) is at least as long as one-fifth the width of the head. *Lasius alienus* has no erect hairs on its antennal scapes or its rear tibiae, and in New England it is found mostly in forests. The other three species in this group, *L. neoniger*, *L. pallitarsis*, and *L.* cf. *niger*, all have some erect hairs on their antennal scapes and their rear tibiae. *Lasius pallitarsis* is distinguished by the small offset tooth on the top of its mandible (closest to the head). In northern New England, *L. pallitarsis* is most frequently collected in open fields. *Lasius neoniger* has "normal" teeth on its mandibles and in New England is most common in open habitats, including fields and sand

dunes. *Lasius* cf. *niger* is the hairiest of them all and closely resembles the western North American and European *L. niger.* Our first New England record of this species was collected at the seaward edge of a salt marsh in Falmouth, Massachusetts, in summer 2011, again demonstrating that new discoveries in the New England ant fauna are being made all the time!

The *flavus* group—The two species of the *flavus* group have the smallest eyes of all our *Lasius* species: not only is the length of the eye much less than one-sixth the width of the head but there are always fewer than 35 facets (ommatidia) on each compound eye. Unfortunately, the only character that distinguishes *L. flavus* from *L. nearcticus* is the length of the last segment of the maxillary palp relative to the next-to-last segment. In *L. flavus* the last segment of the palp is (usually) shorter than or (occasionally) equal in length to the penultimate segment. In contrast, the last segment of the palp of *L. nearcticus* is always longer than the next-to-last segment. In general, *L. nearcticus* is found in forests, whereas *L. flavus* is found in open and early successional habitats like grasslands and farm fields, but we have found the two species co-occurring in early and midsuccessional habitats, including old fields and young woodlands.

The matrix key below illustrates four morphological characters and the most common habitat of each of the six species in the *niger* and *flavus* groups. The profiles are approximately four times the size of a major worker and are ordered by size. The primary characteristics to look for on the head in side view are the size of the eye (length >0.2 times the width of the head in the *niger* group and length $\ll 0.16$ times the width of the head in the *flavus* group), and the presence or absence of hairs on the antennal scape. The density of hairs on the gaster and the presence or absence of hairs on the hind tibia further separate those species. In general, *L. flavus* and *L. nearcticus* occur in different habitats, but measure the last two segments of the maxillary palps at 50× magnification to be sure.



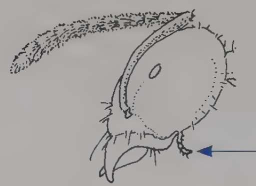
The *umbratus* group—The last five *Lasius* species are in this group, and have medium-sized eyes: the eye length is approximately one-sixth the width of the head, and each compound eye always has more than 35 facets. Like the species in the *claviger* group, the species in the *umbratus* group are all social parasites on other *Lasius* species. Once again, the distribution and size of appressed pubescence (flattened hairs) and erect hairs are used to distinguish the species. The rarely collected *Lasius speculiventris* is unique in the group because the second tergite of its gaster is quite shiny: it completely lacks any appressed pubescence, although this tergite may have three to five scattered erect hairs. The remaining four species all have both appressed pubescence and many erect hairs on all segments of their gasters. *Lasius minutus* and *L. subumbratus* both have long, erect hairs on the first segment of the gaster. On *L. minutus,* these erect hairs are as long as or longer than the maximum width of the hind tibia (a useful relative measurement), but this species has no erect hairs on its tibiae. In contrast, the erect hairs on the first segment of the gaster of *L. subumbratus* are 0.6–0.8 times as long as the hind tibia is wide, and there are erect hairs on this ant's hind tibiae. The erect hairs on the gaster of *L. umbratus* are short and stubble-like, <0.5 times as long as the hind tibia is wide, and this species has no erect hairs on either its antennal scape or its hind tibiae. An as-yet-undescribed species, *Lasius* cf. *umbratus,* has similarly short and stubble-like erect hairs on its gaster, but it also has erect hairs on both its antennal scape and its hind tibiae. The species of the *umbratus* group can be found in a wide range of habitats. *Lasius speculiventris* has been collected from bogs, fens, and moist woods, and *L. minutus* is most frequently found in bogs and fens. The remaining three species are generally found in lawns, open fields, and early successional forests.

The matrix key below illustrates four morphological characters and the most common habitat of each of the five species in the *umbratus* group. All of these species have similar, medium-sized eyes (length ~ one-sixth the

width of the head). The profiles are approximately five times the size of a major worker and are ordered by size. The primary characteristics to look for on the head in side view are the presence or absence of erect hairs on the antennal scapes and on or under the cheeks. The density of pubescence and the lengths of the erect hairs on the gaster and the presence or absence of hairs on the hind tibia further separate the species. *Lasius speculiventris* is a moist-woods species that also nests in bogs and fens, whereas *L. minutus* is most frequently found in bogs. The other three species are less habitat specific.

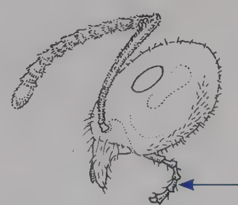
Key to the Species of *Lasius*

1a. **The maxillary palps are short and inconspicuous, with 3 segments**; these ants give off a very strong lemony or citronella odor when disturbed; the angle between the dorsal (top) and rear (declivity) faces of the propodeum is rounded .... (*claviger* group) 2



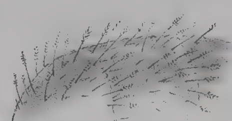
3-segmented palps in the *claviger* group

1b. **The maxillary palps are long and conspicuous, with 6 segments**; these ants do not give off a lemony or citronella odor when disturbed; the angle between the dorsal face of the propodeum and its declivity is sharp..............................7



6-segmented palps in all other *Lasius* groups

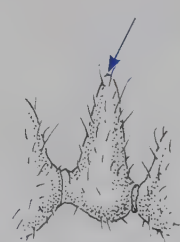
2a (1a). **The hairs on the gaster have feathery (plumose) tips** (best viewed obliquely using a dissecting microscope at 50–100x magnification); this ant is currently unknown from New England .... *L. plumopilosus*, p. 199



Plumose hairs of *L. plumopilosus*

2b. **The hairs on gaster have straight tips** without feathered ends 3

3a (2b). **The petiole, viewed in profile, is sharp and pointed**; when viewed from the front, the petiole has a shallow to sharp depression in its center; the cheeks, viewed from the side, have sparse erect hairs, or, if the hairs are dense, they are limited to the upper (posterior) two-thirds of the cheeks 4

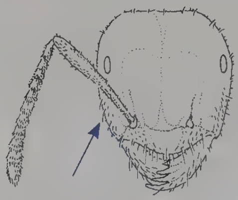


Sharp-topped petiole of *L. interjectus*

3b. **The petiole, viewed in profile, is rounded and blunt;** the cheeks, viewed from the side, have erect hairs distributed over the entire surface 6

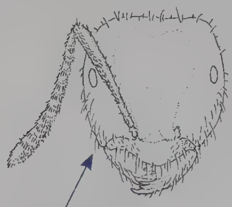
Blunt-topped petiole of *L. latipes*

4a (3a). **The hairs on the body are thin and wispy; the hairs on the cheeks are short**...... *L. subglaber,* p. 201



Short cheek hairs on *L. subglaber*

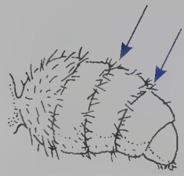
4b. **The hairs on the body are thick and coarse; the hairs on the cheeks are long**.................................... 5



Long cheek hairs on *L. claviger*

5a (4b). **Erect hairs are present on all surfaces of all segments of the gaster;** the hairs on the ventral surface of the head are long......*L. claviger,* p. 190

5b. **Erect hairs are present on the entire surface of the 1st segment of the gaster but are present only on the posterior edges of the 2nd and 3rd segments;** there are few hairs on the ventral surface of the head .... *L. interjectus,* p. 192



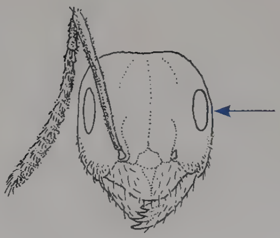
Hairs only on the edges of the 2nd and 3rd gastral tergites of *L. interjectus*

Lasius

6a (3b). **The ant is very hairy all over;** there are many long hairs on the cheeks.................. *L. latipes,* p. 193

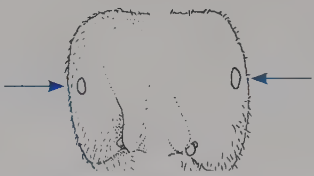
6b. **The hairs on the propodeum are denser than elsewhere;** the hairs on the cheeks are short........... ....*L. murphyi,* p. 195

7a. (1b). **These ants have large eyes (eye length greater than one-sixth the width of the head);** the color of the ant is golden brown to dark brown....... (*niger* group) 8



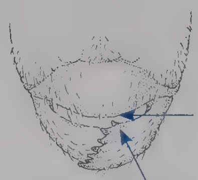
Large eyes in the *niger* group

7b. **These ants have small eyes (eye length less than one-sixth the width of the head);** its nests can be deep underground; its color is yellow to brown 11



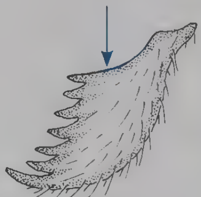
Very small eyes in the *flavus* group (left) and intermediate-sized eyes in the *umbratus* group (right)

8a (7a). **The basal tooth of the mandible (i.e., the tooth closest to the head) is offset from and smaller than the others;** there are 7 teeth on the mandible, but because the basal tooth is offset, it may appear that there are only 6; the anterior margin of the clypeus is broadly curved; erect hairs are present on the scape and tibia; the ant's color is dark brown.. *L. pallitarsis*, p. 198



Broadly curved clypeal margin and offset basal tooth on the mandible of *L. pallitarsis*

8b. **The basal tooth of the mandible is aligned with the rest of the teeth and normal in size;** there are 7 teeth on the mandible, and all are usually visible; the anterior margin of the clypeus may be broadly curved or sharply angular in the middle 9



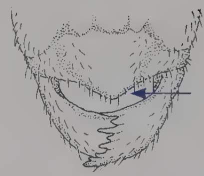
Absence of offset basal tooth on the mandible of other *niger* group species

Lasius

9a (8b). **There are usually no erect hairs** (if present, always < 10) **on the antennal scape or tibia**; the ant's color is dark brown; it is found in forested habitats in New England .... *L. alienus*, p. 189

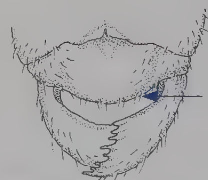
9b. **There are many erect hairs on the antennal scape** (usually) **and on the tibia** (always); these ants are golden brown; they are found in open habitats 10

10a (9b). **With the mandibles fully open and the head positioned in full-face view, the anterior margin of the clypeus is sharply angled**; the basal 2–3 teeth on the mandible are irregularly spaced, and the 2nd tooth is usually much smaller than the 1st or 3rd tooth .... *L. neoniger*, p. 197



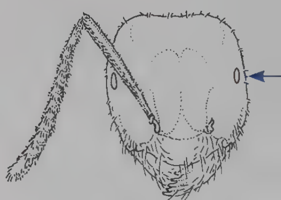
Angular clypeal margin of *L. neoniger*

10b. **With the mandibles fully open and the head positioned in full-face view, the anterior margin of the clypeus is broadly curved**; the basal 2–3 teeth on the mandible are regularly spaced and equal in size .... *L.* cf. *niger*, p. 204



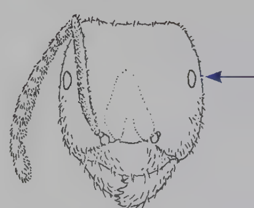
Broadly curved clypeal margin of *L.* cf. *niger*

11a (7b). **The length of each eye is much shorter than one-sixth the width of the head; eyes have < 35 facets** .... (*flavus* group) 12



Small-sized eyes of the *flavus* group

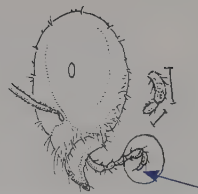
11b. **The eyes are about one-sixth as long as the head is wide and always have > 35 facets**; all species are temporary social parasites on other species of *Lasius* .... (*umbratus* group) 13



Medium-sized eyes of the *umbratus* group

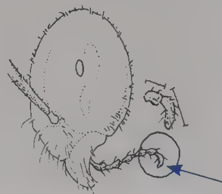
Lasius

12a (11a). **The terminal segment of the maxillary palp is usually shorter, but never longer, than the next-to-last segment;** the ant's color is yellow to dark yellow-brown; it is usually found in open habitats .... *L. flavus*, p. 191



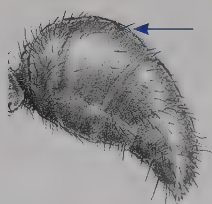
Relatively short terminal segment of the maxillary palp of *L. flavus*

12b. **The terminal segment of the maxillary palp is always longer than the next-to-last segment;** the ant's color is pale to medium yellow; it is usually found in forested habitats.. *L. nearcticus*, p. 196



Relatively long terminal segment of the maxillary palp of *L. nearcticus*

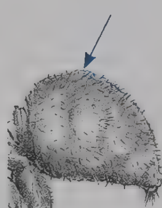
13a (11b). **The 2nd gastral segment is shiny and lacks *appressed* hairs (pubescence)** but may have at most a few scattered erect hairs; the ant's color is dark yellow to medium brown; it occurs in bogs, fens, and moist woods... *L. speculiventris*, p. 200



No appressed hairs on the very shiny 2nd gastral segment of *L. speculiventris*

13b. **The 2nd gastral segment is dull, with both appressed hairs (pubescence) and many erect hairs** 14

14a (13b). **The longest hairs of the 1st gastral segment are short and stubble-like,** less than half the width of the hind tibia at its midpoint 15

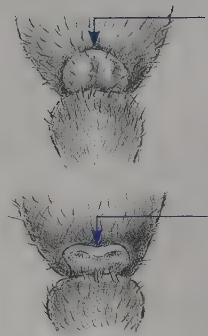


Stubbly hairs on the gasters of *L. umbratus* and *L.* cf. *umbratus*

14b. **The longest hairs of the first gastral segment are long** (more than two-thirds the width of the hind tibia); these ants are found in moist, disturbed, and early successional habitats................................16

15a (14a). **The petiole viewed from the front (or rear) is concave on top**; no erect hairs are present on the scape or tibia.. *L. umbratus*, p. 203

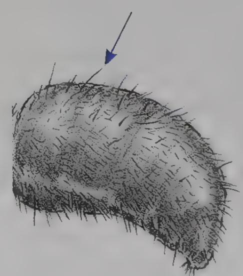
15b. **The petiole viewed from the front (or rear) is convex on top**; erect hairs are present on the scape and hind tibia..................................... *L.* cf. *umbratus*, p. 205



Convex petiole of *L.* cf. *umbratus* (top) and concave petiole of *L. umbratus* (bottom)

16a (14b). **The hairs on the gaster are between two-thirds and four-fifths the maximum width of the hind tibia**; there are some erect hairs present on the tibia; the petiole viewed from front or rear is evenly convex at top; the ant's color is clear yellow..........*L. subumbratus*, p. 202

16b. **The hairs on the gaster are as long as or longer than the maximum width of the hind tibia**; no erect hairs are present on the tibia; the ant's color is brownish-yellow; it is found in open habitats, especially bogs, fens, and sedge meadows.................... *L. minutus*, p. 194



Very long hairs on the gaster of *L. minutus*

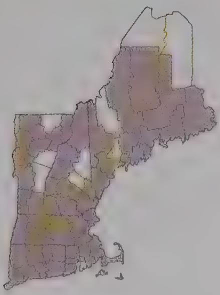
Easily Confused Species

Lasius species can be mistaken for the similarly sized, shaped, and colored *Tapinoma*, *Brachymyrmex*, or *Nylanderia* species. *Lasius* has 12-segmented antennae (*Brachymyrmex* has 9-segmented antennae), and its gaster terminates in an acidopore (*Tapinoma*'s terminates in a horizontal slit). The angular profile of the mesosoma of *Lasius*, along with its generally dense pubescence and fuzzy appearance, distinguish it from *Nylanderia*, which has a lumpy, rounded mesosoma with paired, erect, black hairs.

Lasius alienus (Foerster, 1850)

*The Cornfield Ant

Refers to its unique morphology relative to *Formica* species: *alienus* (Lat: belonging to another [place or person]).



Habitat: In North America, mostly forests, nesting in soil, in and under rotten logs and stumps, rarely in deep leaf litter; occasionally bogs and other wetlands, nesting in peat. In Europe, mostly agricultural fields; hence "The Cornfield Ant."

Geographic range: Holarctic. In North America: Nova Scotia west to southern British Columbia; south to northern Florida; the mountains of the Southwest United States and Mexico. In Eurasia: British Isles and Scandinavia south to Morocco, Tunisia; east into Lebanon, northern Iraq, southern China; northwest into Russia, Central Asia, China, Japan.

Natural history: Can form large, polygynous colonies, but individual queens disperse and found colonies independently. Omnivorous: collects elaiosomes from seeds and eats both live and dead insects; tends aphids, scales, treehoppers, root-feeding coccids.

Look-alikes: *Lasius niger*–group species; *L. alienus* lacks erect hairs on its scape and hind tibiae, whereas the others are hairy. Rarely confused with *Formica* species; Arnold Foerster originally named it *Formica aliena* in reference to its clear morphological differences from the many other *Formica* species he described simultaneously.

Distinguishing features:

A. Propodeum pyramidal in profile

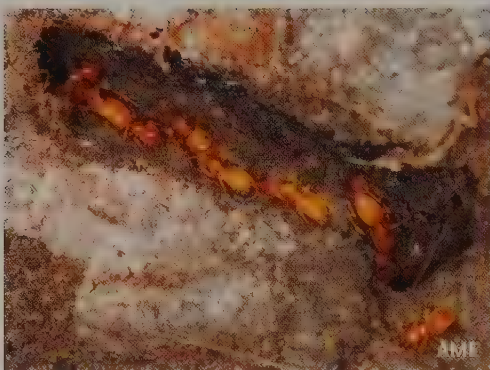
B. Eye relatively large

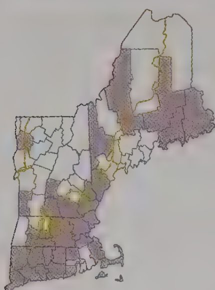
C. Scape without erect hairs (cf. *L. neoniger, L. pallitarsis*)

Lasius claviger (Roger, 1862)

*The Smaller Yellow Ant

Refers to its clubbed antenna: *clavis* (Lat: club) + *gero* (Lat: bear, carry).



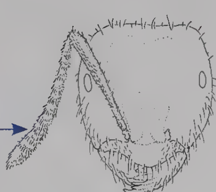


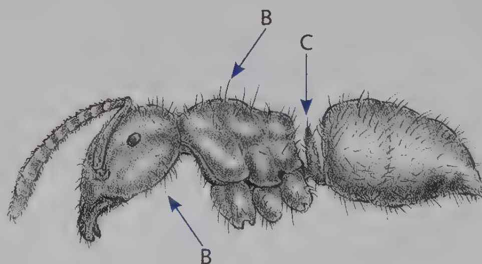
Habitat: Young to mature forests; nests in soil or well-decayed tree stumps, under stones.

Geographic range: Southern New England west to Minnesota, Kansas; south into the Florida panhandle.

Natural history: A temporary social parasite of *L. alienus* and *L. neoniger;* forms enormous colonies spread over wide areas. Workers are generalist predators and feed on honeydew secreted by root-feeding mealybugs. Mating flights occur late September to early October. Mated queens overwinter under rocks or wood and emerge in spring to seek host nests. Smells like citronella when disturbed or crushed.

Look-alikes: *Lasius interjectus, L. latipes, L. subglaber;* pilosity and petiole shape distinguish them.

A




Distinguishing features:

A. Antennae modestly clubbed

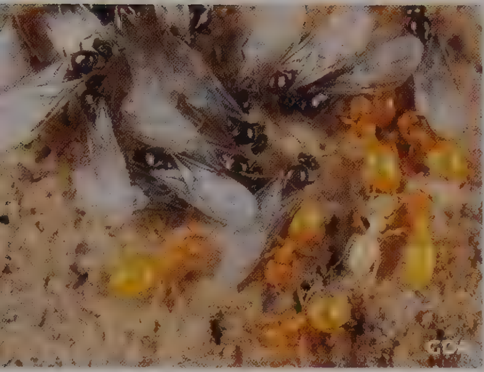
B. Long, dense hairs under the head and all over the body (cf. *L. interjectus, L. subglaber*)

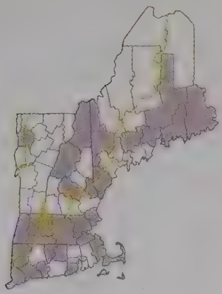
C. Petiole sharply pointed (cf. *L. latipes*)

Lasius flavus (Fabricius, 1782)

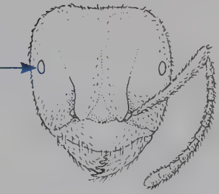
The Blond Fuzzy Ant

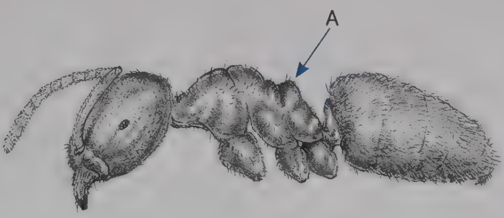
Refers to its color: *flavus* (Lat: blond, yellow).

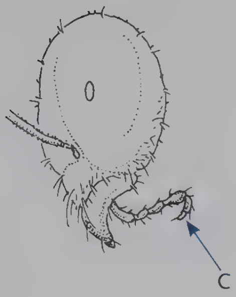




Habitat: Subterranean; nests under rocks in open habitats and dry woodlands.
Geographic range: Holarctic. In North America, abundant in eastern states and widespread in New England; rare along the Gulf Coast; occasionally collected in the northern Rocky Mountains, the Chiricahua Mountains (southeast Arizona), and the Pacific Northwest.
Natural history: A generalist predator that also tends root aphids for honeydew. Mating flights occur late August to early September.
Look-alikes: *Lasius nearcticus;* habitats differ, but reliably distinguished only by the ratio of the lengths of the terminal and penultimate segments of the maxillary palp: ≤1 in *L. flavus* (measured at 25–50×).







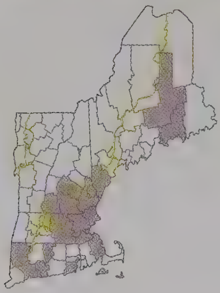
Distinguishing features:
A. Propodeum pyramidal in profile
B. Eyes very small (cf. *L. umbratus* group)
C. Terminal segment of maxillary palp shorter than penultimate segment (cf. *L. nearcticus*)

Lasius

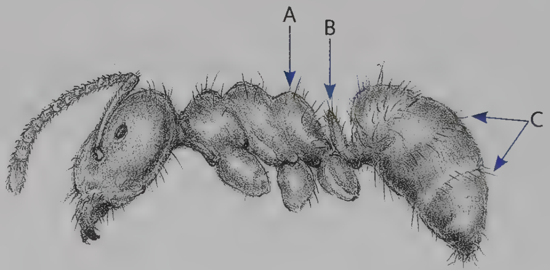
Lasius interjectus Mayr, 1866

*The Larger Yellow Ant

Refers to its intermediate morphology: *interiectus* (Lat: the place between).



Habitat: Widespread under rocks in woods and deep in the soil.
Geographic range: Southern New England west to Idaho, Wyoming; south into New Mexico; back east into Oklahoma, Arkansas, Georgia.
Natural history: Forms enormous, diffuse, wide-ranging colonies. This generalist predator also tends root-feeding aphids for honeydew. Smells like citronella when disturbed or crushed.
Look-alikes: *Lasius claviger, L. latipes, L. subglaber;* a sharply pointed petiole and erect hairs only on the posterior edges of gastral segments 2–3 identify it. Gustav Mayr named it *L. interjectus* because he considered it a transitional form between *Lasius* sensu stricto and *Lasius* subgenus *Acanthomyops* (what we now call the *claviger* group).



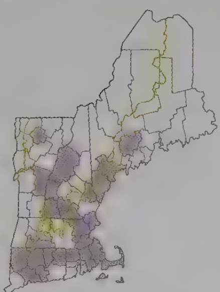
Distinguishing features:
A. Propodeum rounded in profile (cf. *L. umbratus* group)
B. Petiole sharply pointed in profile (cf. *L. latipes*)
C. Erect hairs only on edges of gastral tergites 2–3 (cf. *L. claviger*)

Lasius

Lasius latipes (Walsh, 1863)

The Wide-footed Fuzzy Ant

Refers to the queen's enlarged front legs: *latus* (Lat: wide) + *pes* (Lat: foot).

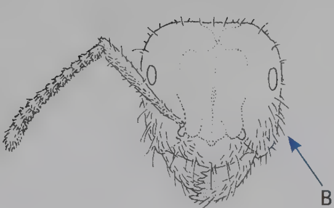


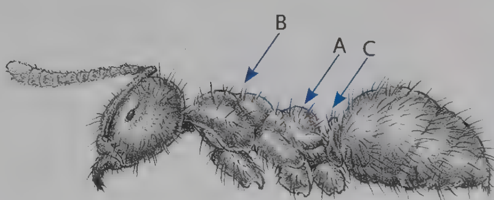
Habitat: Nests under rocks in sandy, well-drained soils of open forests and woodlands such as pine barrens.

Geographic range: New England and Quebec west to southern British Columbia; south to California, Nevada, New Mexico; back east into Oklahoma, South Carolina.

Natural history: A temporary social parasite on *L. alienus* and *L. neoniger;* the queen uses her enlarged front legs to rapidly dig a new nest. Workers are generalist predators that also feed on honeydew secreted by root-feeding aphids. Smells like citronella when disturbed or crushed. A particularly nice collection of *L. latipes* in the Maine State Collection was found over Labor Day Weekend in 1971 swarming in a cellar drain in Augusta, Maine.

Look-alikes: *Lasius claviger;* the blunt, rounded petiole is diagnostic. Queens, with enlarged front legs, are unmistakable.





Distinguishing features:

A. Propodeum rounded in profile

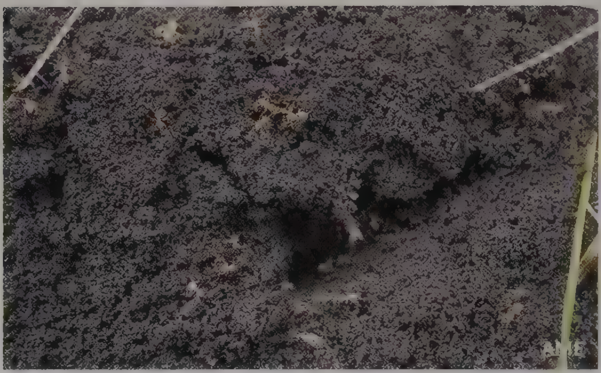
B. Cheeks and body with many erect hairs

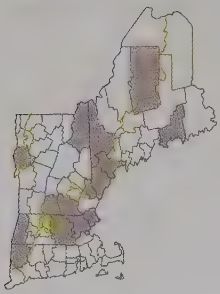
C. Petiole blunt and rounded in profile (cf. *L. claviger*)

Lasius minutus Emery, 1839

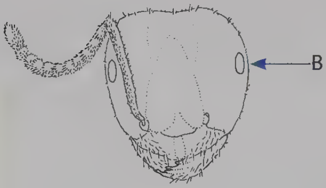
The Tiny-queened Fuzzy Ant

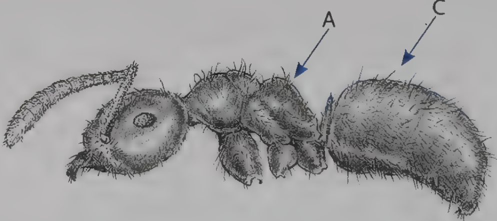
Refers to the size of the queens relative to the workers: *minutus* (Lat: small).





Habitat: Bogs and fens. Its nests can be large mounds up to 0.5 m tall.
Geographic range: Eastern North America south to Virginia; west to Indiana.
Natural history: Thought to be a temporary social parasite of *L. alienus* and *L. pallitarsis*. Also the host of the temporary social hyperparasite (i.e., a parasite of a parasite) *L. speculiventris*. Despite its scientific name, workers are not unusually small, but queens are.
Look-alikes: *Lasius subumbratus;* the hairs of *L. minutus* are very long—longer than the hind tibia is wide.





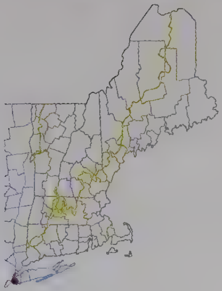
Distinguishing features:
A. Propodeum pyramidal in profile
B. Eyes intermediate in size (cf. *L. neoniger, L. pallitarsis*)
C. Erect hairs on gaster longer than tibial width (cf. *L. subumbratus*)

Lasius

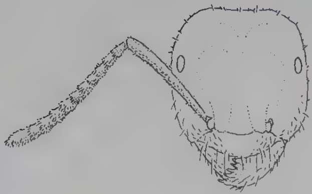
Lasius murphyi Forel, 1901

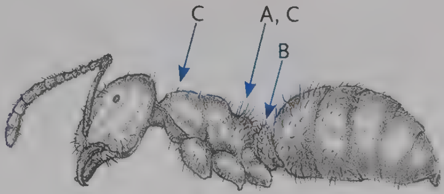
Murphy's Fuzzy Ant

Honors the hospitality and friendship of one Dr. Murphy, "directeur de l'asile des alienes" (director of the insane asylum).



Habitat: Open woods, forest edges, pine barrens; nests under or next to rocks.
Geographic range: East of the Mississippi River south to Georgia and the Carolinas; scattered records from Colorado, Utah, northern Arizona; not yet recorded from New England, but as the climate warms, look for it in pine barrens and sandy areas of southern New England.
Natural history: A temporary social parasite of *Lasius neoniger*. *Lasius murphyi* hybridizes with *L. latipes* and *L. subglaber* in the field. Smells like citronella when disturbed or crushed.
Look-alikes: *Lasius claviger, L. latipes;* petiole shape and pilosity distinguish them. Queens of *L. murphyi* have distinctive, heavily matted body hairs.





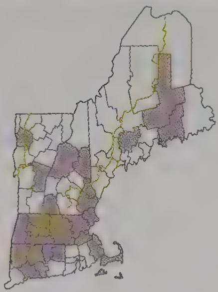
Lasius

Distinguishing features:
A. Propodeum rounded in profile
B. Petiole blunt, rounded in profile (cf. *L. claviger*)
C. Erect hairs dense on propodeum, sparse elsewhere (cf. *L. latipes*)

Lasius nearcticus Wheeler, 1906

The New World Fuzzy Ant

Refers to its geographic area: *nearcticus* (Lat: the northern [Arctic] regions of the "New World").

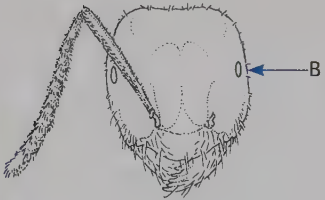


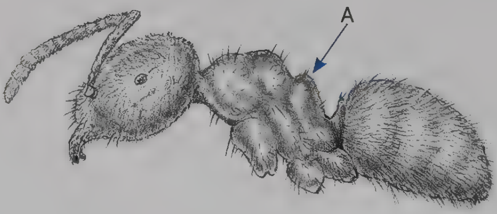
Habitat: Nests under rocks in moist forests.

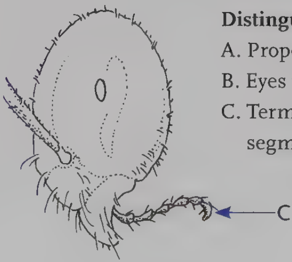
Geographic range: Southeastern Canada to the southern Appalachian Mountains; west to South Dakota, Wyoming.

Natural history: Rarely studied because it lives and forages almost exclusively underground. Thought to feed on honeydew secreted by root-feeding aphids.

Look-alikes: *Lasius flavus;* habitats differ; reliably distinguished only by the ratio of the lengths of the terminal and penultimate segments of the maxillary palp: >1 in *L. nearcticus* (measured at 25–50×).







Distinguishing features:

A. Propodeum pyramidal in profile

B. Eyes tiny

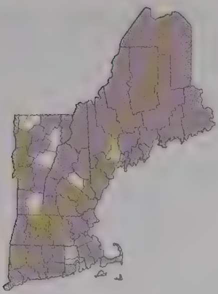
C. Terminal segment of maxillary palp longer than penultimate segment (cf. *L. flavus*)

Lasius

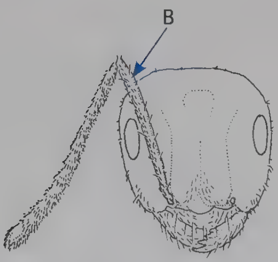
Lasius neoniger Emery, 1893

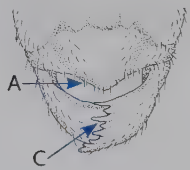
The Labor Day Ant

Refers to its color and similarity to the European *Lasius niger*: *neo-* (Lat: new [New World] + *niger* (Lat: black).



Habitat: Open habitats, including farm fields, old fields, other early successional habitats, beaches, sand dunes.
Geographic range: Eastern North America; ranges west into North Dakota, Iowa, Kansas; sporadic in the southern Rocky Mountains.
Natural history: Nicknamed the Labor Day Ant by Bert Hölldobler and E. O. Wilson because of the propensity for mating swarms to occur on warm evenings following rains in late August and early September. Likely to be ecologically very important because it is abundant in virtually every open habitat on the landscape.
Look-alikes: *Lasius niger*–group species; shape of the anterior clypeal margin, size of basal mandibular teeth, pilosity distinguish them.





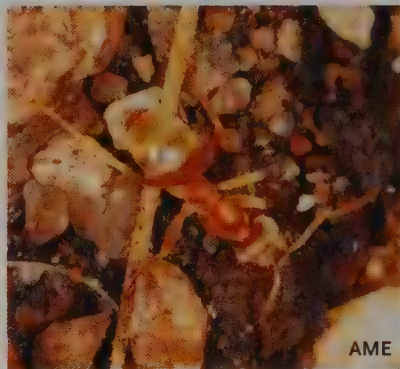
Distinguishing features:
A. Clypeal margin angular (cf. other *L. niger*–group species)
B. Scape with many erect hairs (cf. *L. alienus*)
C. Mandible with basal teeth unequally sized and spaced (cf. *L.* cf. *niger*) and lacking an offset basal tooth (cf. *L. pallitarsis*)

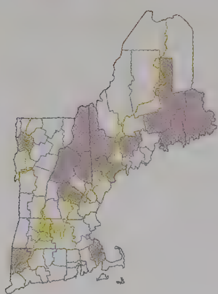
Lasius

Lasius pallitarsis (Provancher, 1881)

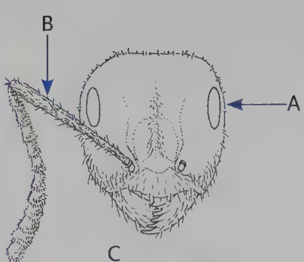
The Pale-legged Fuzzy Ant

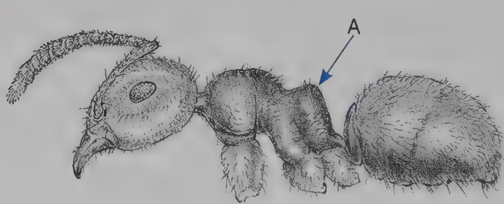
Refers to the color of its toes: *pallidus* (Lat: pale, wan) + *tarsis* (Lat: segment of the leg below the tibia).

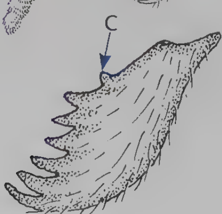




Habitat: Boreal and cold-temperate forests; nests in rotten logs and stumps, under stones. In northern Maine and eastern Canada, also in agricultural fields.
Geographic range: Eastern Quebec across Canada to southeastern Alaska; south to Massachusetts in the east; south through the mountains of California in the west. One record from the southern Appalachian Mountains of North Carolina.
Natural history: A generalist omnivore: eats plant debris and other small insects; tends aphids and other scale insects for honeydew. Parasitized by *L. minutus, L. umbratus, L. subumbratus.*
Look-alikes: *Lasius niger*–group species; the key feature of *L. pallitarsis* is the offset, short, upturned basal mandibular tooth, best seen in full-face view with the mandibles open. If you can't open the mandibles, count the teeth you can see. If you see only 6 (and the offset, 7th one is hidden under the clypeus), it is most likely *L. pallitarsis.*





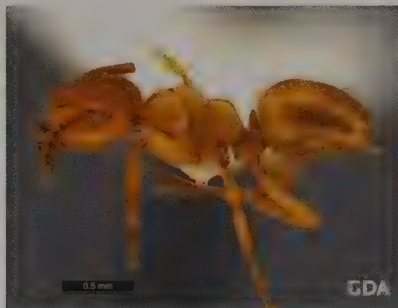


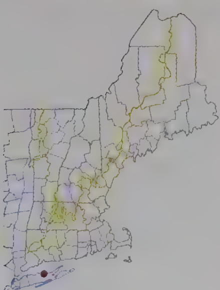
Distinguishing features:
A. Eyes large; propodeum pyramidal in profile
B. Scape with many erect hairs (cf. *L. alienus*)
C. Mandible with offset basal tooth (cf. *L. neoniger* and *L.* cf. *niger*)

Lasius plumopilosus Buren, 1941

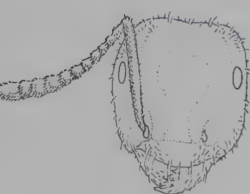
The Feathered Fuzzy Ant

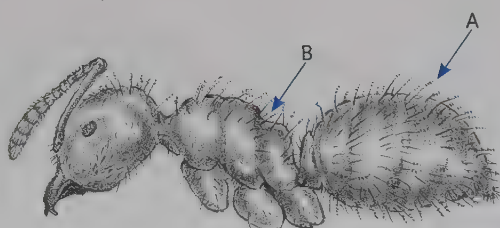
Refers to its gastral hairs: *plumosus* (Lat: feathered) + *pilosus* (Lat: hairs).





Habitat: Subterranean; nests under stones.
Geographic range: Patchy: recorded from Iowa, Michigan, Minnesota, North Carolina, Long Island (New York); unknown from New England, but could occur in Connecticut, Rhode Island, Cape Cod, or the Massachusetts Islands.
Natural history: Rarely collected. Thought to be a social parasite of the social parasite *L. claviger.* Social hyperparasitism is rare among ants, but occurs among some European and Asian *Lasius* species. Smells like citronella when disturbed or crushed.
Look-alikes: Unmistakable; the feather-tipped hairs on its gaster are unique.





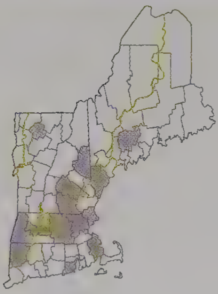
Lasius

Distinguishing features:
A. Erect hairs on the gaster feather tipped
B. Propodeum rounded in profile

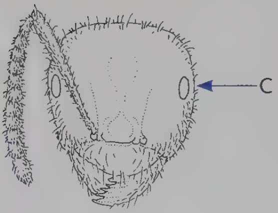
Lasius speculiventris Emery, 1893

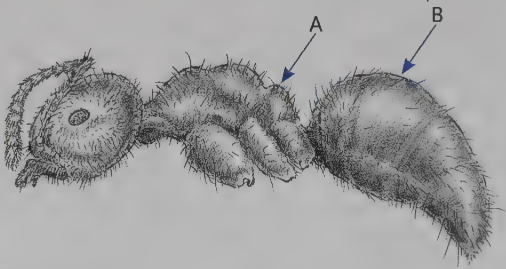
The Shiny-bellied Fuzzy Ant

Refers to its gaster: *specula* (Lat: shiny like a mirror) + *ventris* (Lat: belly).



Habitat: Nests in rotten logs in bogs, fens, moist woodlands.
Geographic range: Northeastern and Great Lakes states.
Natural history: Rarely found or studied. Reported to be a social parasite of the social parasite *L. minutus,* but such social hyperparasitism is rare in ants.
Look-alikes: *Lasius umbratus*–group species; distinguished by the shiny second segment of its gaster, which lacks appressed pubescence and has only a few erect hairs. Carlo Emery described it thus: "Hinterleib stark glanzend, ohne anliegende Behaarung" (Its abdomen is strongly shining, without any appressed pubescence).





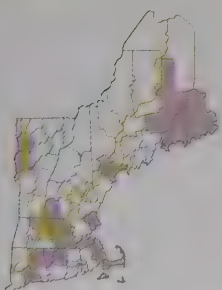
Distinguishing features:
A. Propodeum pyramidal in profile
B. Gastral tergite 2 without appressed pubescence
C. Eye intermediate in size

Lasius

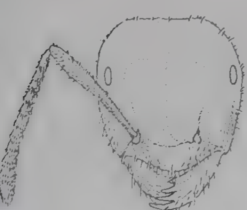
Lasius subglaber Emery, 1893

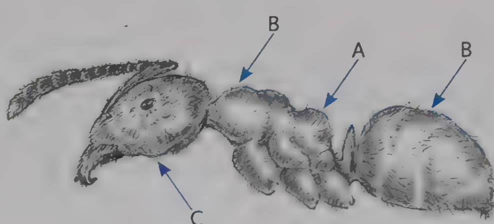
The Somewhat Hairy Fuzzy Ant

Refers to its pilosity: *sub-* (Lat: less perfect than) + *glaber* (Lat: smooth and hairless).



Habitat: Nests under stones, in rotten stumps or small soil mounds in forests and small tree-fall gaps.
Geographic range: North Dakota east to Down East Maine, southern New York; south to North Carolina and Georgia.
Natural history: Rarely collected or studied. Assumed to feed on honeydew secreted by root-feeding aphids. Smells like citronella when disturbed or crushed.
Look-alikes: *Lasius claviger, L. interjectus; L. subglaber* uniquely has few (short, wispy) erect hairs on its body and virtually none on its cheeks.



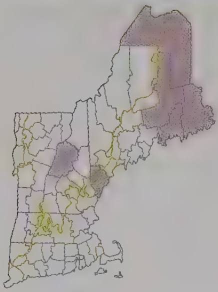


Distinguishing features:
A. Propodeum is rounded in profile.
B. Erect hairs on body are short, wispy (cf. *L. claviger, L. interjectus*).
C. Cheeks lack long erect hairs (cf. *L. claviger, L. interjectus*).

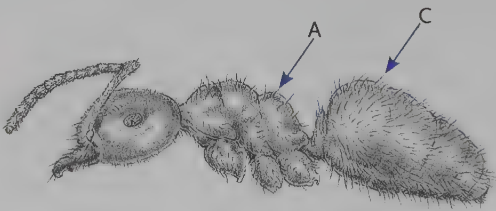
Lasius subumbratus Viereck, 1903

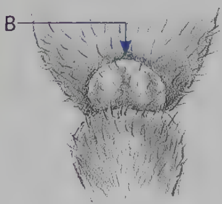
The Less Shady Fuzzy Ant

Refers to its similarity to *Lasius umbratus: sub-* (Lat: less than perfect) + *umbratus* (Lat: shaded in color).



Habitat: Wherever *L. pallitarsis* is found (in rotten logs and stumps and under stones), there also may be *L. subumbratus.*
Geographic range: The Canadian Maritime Provinces west to western North America. In New England, confined to cold-temperate and sub-boreal areas; as yet collected only from Maine and New Hampshire's White Mountains.
Natural history: A temporary social parasite of *L. pallitarsis.*
Look-alikes: *Lasius minutus, L. umbratus;* petiole shape and length of gastral hairs distinguish them.





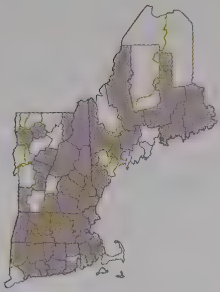
Distinguishing features:
A. Propodeum pyramidal in profile; eyes intermediate in size
B. In posterior view, petiole convex on top (cf. *L. umbratus*)
C. Erect hairs on gaster shorter than hind tibial width (cf. *L. minutus*)

Lasius

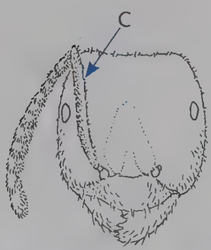
Lasius umbratus (Nylander, 1846)

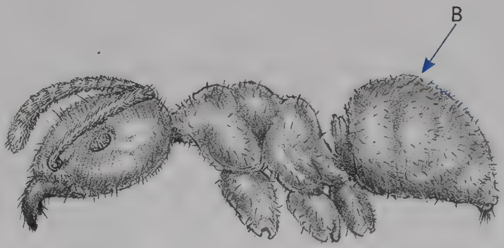
The Shaded Fuzzy Ant

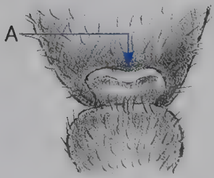
Refers to its color: *umbratus* (Lat: shaded, light brown).



Habitat: Nests in moist soil in open woodlands and early successional forests, at forest edges, in farm fields.
Geographic range: Holarctic.
Natural history: A social parasite of *L. alienus, L. neoniger, L. pallitarsis.*
Look-alikes: *Lasius minutus, L. subumbratus, L.* cf. *umbratus;* petiole shape, pilosity, length of gastral hairs distinguish them.

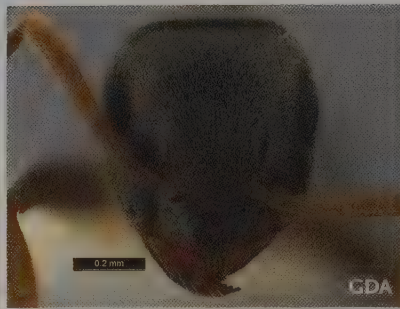


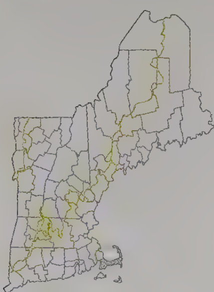




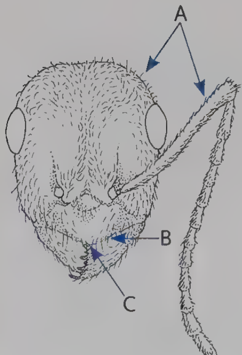
Distinguishing features:
A. Viewed posteriorly, petiole concave on top (cf. *L. subumbratus*)
B. Erect hairs on gaster short, bristly (cf. *L. minutus, L. subumbratus*)
C. Scape and hind tibiae without erect hairs (cf. *L.* cf. *umbratus*)

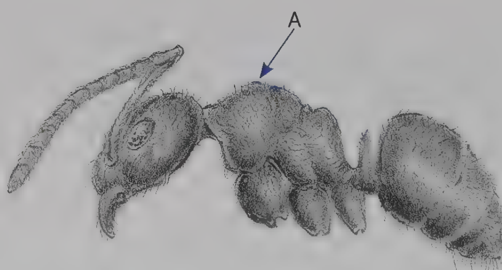
An uncertain species of *Lasius* closely resembling *L. niger*





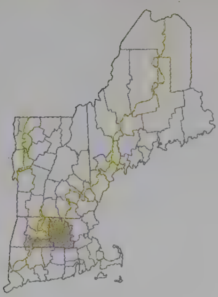
Habitat: Unknown. First collected in the summer of 2011 from the edge of the Great Sippewisset salt marsh near Falmouth, Massachusetts.
Geographic range: Unknown. As of this writing, this species has been collected only in the town of Falmouth, Massachusetts. It closely resembles *Lasius niger,* which ranges throughout Europe, northern and central Asia, China, Japan, and Korea. In North America, *L. niger* is a western species that has been collected only from Washington, Oregon, California, Idaho, Montana, Colorado, Utah, and New Mexico.
Natural history: Unknown. Only representatives of a single colony have so far been collected in New England.
Look-alikes: *Lasius neoniger, L. pallitarsis;* the uncertain species is much hairier than either of them.





Distinguishing features:
A. Scape, head, body with very long, dense hairs (cf. *L. alienus*)
B. Clypeal margin rounded (cf. *L. neoniger*)
C. Basal tooth of mandible not offset (cf. *L. pallitarsis*)

An undescribed species of *Lasius* closely resembling *L. umbratus*

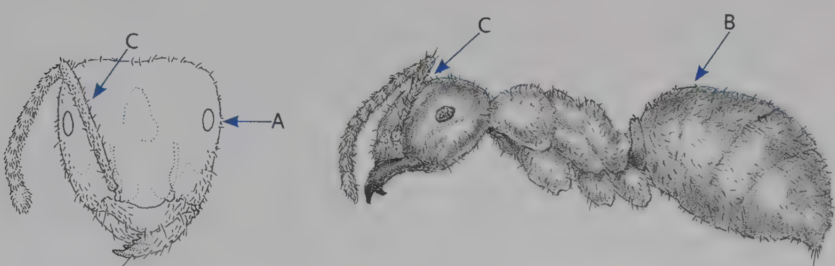


Habitat: Unknown. Collected only from mown lawns and fields in Massachusetts.

Geographic range: Unknown. As of this writing, this undescribed species has been collected only in the towns of Hamden (1985) and Athol, Massachusetts (2010).

Natural history: Unknown.

Look-alikes: *Lasius umbratus;* the undescribed species has erect hairs on its antennae and hind tibiae, whereas *L. umbratus* does not.



Distinguishing features:

A. Eyes intermediate in size (cf. *L. neoniger*)

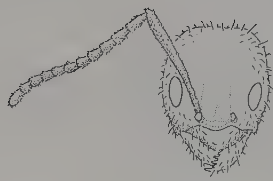
B. Erect hairs on gaster short, bristly (cf. *L. minutus, L. subumbratus*)

C. Scape and hind tibiae with erect hairs (cf. *L. umbratus*)

Nylanderia Emery, 1906

Nylander's Ants

Named for the Finnish entomologist and lichenologist William Nylander (1822–1899).



The genus *Nylanderia* has an interesting and checkered history. The name *Nylanderia* was first used in 1906 to refer to a subgenus of *Prenolepis.* Thirty years later it was given full status as its own genus, but it was then lobbed back and forth between full generic status and subgeneric status within *Paratrechina* for another 50 years. In the mid-1980s, *Nylanderia* lost its identity entirely when it was completely subsumed within *Paratrechina.* In 2010, DNA sequence data not only reconfirmed its place as a distinct genus, but also ironically placed most species of *Paratrechina* within *Nylanderia*! With hindsight, it now seems easy to distinguish among these three genera of the so-called *Prenolepis* genus group. *Nylanderia* is separated from *Paratrechina* on the basis of two key characteristics: the mandibles of *Nylanderia* have six teeth (*Paratrechina* has five-toothed mandibles), and the antennal scapes of *Nylanderia* are less than 1.5 times as long as the length of the head (the antennal scapes of *Paratrechina* are more than 1.7 times as long as the length of the head). On the other hand, *Nylanderia* is separated from *Prenolepis* using two other characters: the eyes of *Nylanderia* are situated midway up the head, with half of their length above and the other half below the midline (the eyes of *Prenolepis* are situated much higher up the head), and the mesosoma of *Nylanderia* is not constricted behind the pronotum (*Prenolepis* has such a constriction, giving it an hourglass appearance in dorsal view, i.e., when viewed from above).

Nylanderia now includes approximately 133 species, at least 20 of which (including four exotics) occur in North America. But in New England, only two species of *Nylanderia* can be found out of doors: *N. parvula* and an unnamed, workerless species that is a social parasite of *N. parvula*. A third species, *N. flavipes,* is a forest species of Asian origin that is common in wooded median strips in Manhattan (and forests farther south), but in New England only occasionally turns up in greenhouses or other heated buildings.

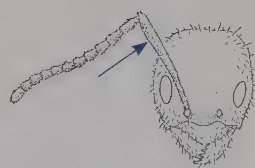
Identifying the Species of *Nylanderia*

Of the three New England species in this genus, *N. parvula* is the most widespread and easily identified. It is a small (approximately 2.25 mm long), shiny, dark brown or black ant that, in profile, looks like a tiny *Formica*. It

has many erect hairs on its head and body, few or no erect hairs on its propodeum, and no erect hairs on its antennal scape. The other named species of *Nylanderia, N. flavipes,* has at least several erect hairs on its scape and is red to reddish brown, sometimes even appearing bicolored. Finally, the undescribed species of *Nylanderia* is an inquiline social parasite of *N. parvula.* This undescribed species produces no workers, only queens and males, that live in nests of *N. parvula.* The unnamed social parasite can be distinguished from the host (*N. parvula*) by size: the parasite queen is about two-thirds the length of the host queen and about 80% the length of the host worker. In addition, the queens of the parasite always have at least one erect hair on at least one of their antennal scapes (*N. parvula* has hairless scapes). As of this writing, the parasite has been collected in Massachusetts only at Myles Standish State Forest, but it could be as widespread as its host.

Key to the Species of *Nylanderia*

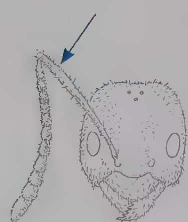
1a. **Antennal scapes without erect hairs**; workers lack ocelli; this is a native, widespread species .... *N. parvula,* p. 210



Absence of erect hairs on scapes of *N. parvula*

1b. **Antennal scapes with at least one erect hair, workers with many more hairs**; workers, if present, have small ocelli 2

2a (1b). **Antennal scapes of workers and queens with many erect hairs**; workers with small ocelli; this is an introduced species currently recorded in New England only from inside heated buildings and greenhouses .... *N. flavipes,* p. 209



The many erect hairs on scapes of *N. flavipes*

2b. **Colonies consisting of queens and males relying on host workers of *N. parvula;*** queens have at least one erect hair on at least one of the antennal scapes; host workers lack erect hairs on their antennal scapes; queens < 2 mm long.............An undescribed species of *Nylanderia*, p. 211

Queens of *N. parvula* (top) are much larger than queens of its undescribed parasite (bottom).

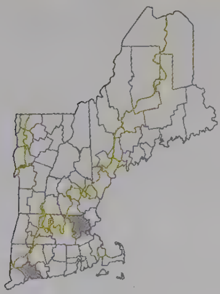
Easily Confused Species

Nylanderia species can be mistaken for their close relatives, *Paratrechina* or *Prenolepis,* or for the similarly sized, shaped, and colored *Tapinoma, Brachymyrmex,* or *Lasius* species. The antennal scapes of *Nylanderia* and *Prenolepis* are less than 1.5 times the length of its head, whereas the scapes of *Paratrechina* are more than 2 times as long as its head. *Nylanderia* and *Prenolepis* are distinguished by the shape of their mesosomas viewed from above (there is no constriction behind the pronotum of *Nylanderia*) and by the position of their compound eyes (midway up the head in *Nylanderia,* above the midline of the head of *Prenolepis*). *Nylanderia,* like other genera in the Formicinae, has a gaster that terminates in an acidopore (*Tapinoma*'s terminates in a horizontal slit). The lumpy, rounded profile and paired, erect, black hairs of the mesosoma of *Nylanderia* distinguish it from *Lasius,* which has an angular, fuzzy mesosoma.

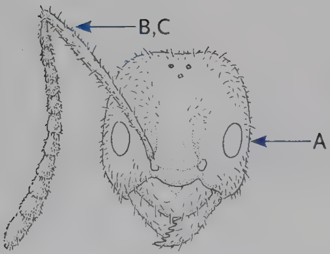
Nylanderia flavipes (Smith, 1874)

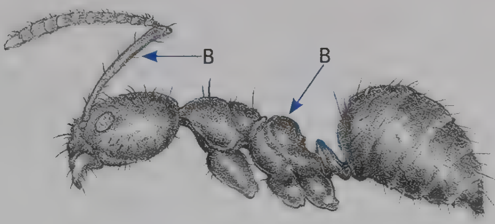
The Yellow-legged *Nylanderia*

Refers to the color of its legs: *flavus* (Lat: yellow) + *pes* (Lat: foot).



Habitat: Urban woodlands, lawns, gardens, parks, median strips.
Geographic range: Japan, Korea, parts of China. Introduced, probably repeatedly, into North America; established populations from Boston to Washington, D.C.; collected in Ohio and Pittsburgh, Pennsylvania.
Natural history: Along the wooded median strips where it nests in North America, *N. flavipes* can be the most abundant ant present. Its propensity for forested habitats suggests that, given appropriate climatic conditions, *N. flavipes* could spread rapidly throughout New England. The usually monogynous colonies have 100–500 workers that are generalist predators and scavengers and tend aphids for honeydew.
Look-alikes: *Lasius neoniger, Brachymyrmex depilis, N. parvula*; hairs on scapes and promesonotum, and color, distinguish them.





Nylanderia

Distinguishing features:

A. Eyes midway up the head (cf. *Prenolepis*)

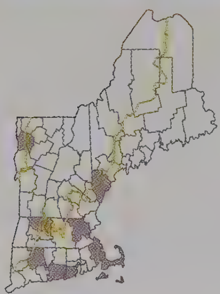
B. Scape with many erect hairs but propodeum without erect hairs (cf. *N. parvula*)

C. Scapes <1.3× head length (cf. *Paratrechina*)

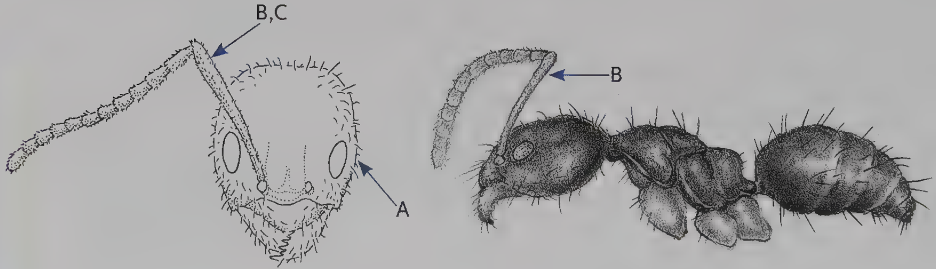
Nylanderia parvula (Mayr, 1870)

The Little *Nylanderia*

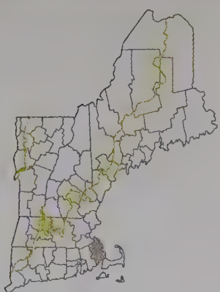
Refers to its small size: *parvulus* (Lat: little, insignificant).



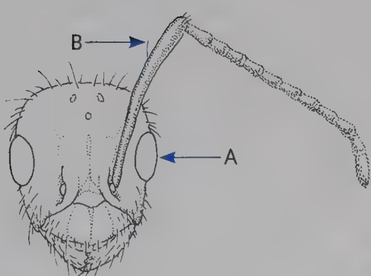
Habitat: Open habitats, old fields, young woodlands; especially pine barrens and other habitats with sandy soils.
Geographic range: Southern Maine south to Florida; west to Michigan, the Dakotas, eastern Texas.
Natural history: Colonies of *N. parvula* are small (<500 workers), usually monogynous, and relatively diffuse, consisting of scattered chambers each containing a few dozen workers and some brood. Solitary foraging workers are scavengers and generalized predators of small soil animals. When a worker finds large food resources, she lays down a scent trail to quickly bring her nestmates to the food.
Look-alikes: *Nylanderia flavipes, Paratrechina longicornis;* scape length and hairs, number of mandibular teeth, and color distinguish them.



Distinguishing features:
A. Eyes midway up the head (cf. *Prenolepis*)
B. Scape lacks erect hairs (cf. *N. flavipes*).
C. Scapes < 1.3× head length (cf. *Paratrechina*)



Habitat: An inquiline social parasite of *N. parvula* known from the pine barrens at Myles Standish State Forest in eastern Massachusetts.
Geographic range: Unknown; likely will overlap that of its host in eastern North America: Maine south to Florida; west to Michigan, the Dakotas, eastern Texas.
Natural history: This inquiline social parasite produces only queens and males that are raised by colonies of its host, *N. parvula*.
Look-alikes: *Nylanderia parvula;* the undescribed species always has at least one erect hair on at least one of its scapes. Its queens are approximately 30% smaller than the queens of *N. parvula* and are yellowish brown; the host queens are slate gray or black.



Distinguishing features:
A. Eyes midway up the head (cf. *Prenolepis*)
B. Scape with at least one erect hair (cf. *N. parvula*)
C. Very small queens (cf. *N. flavipes, N. parvula*)

Nylanderia

Paratrechina Motschoulsky, 1863

The Somewhat Hairy Ant

From the Greek *para*, meaning near or nearby, + *trichinos*, meaning of hair

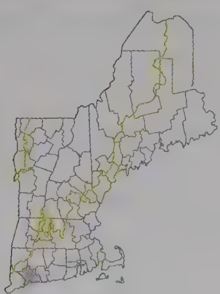
Like other genera in the *Prenolepis* group, the genus *Paratrechina* has a checkered nomenclatural history. The name *Paratrechina* was first used by Victor Ivanovitsch de Motschoulsky in 1863 to refer to a new genus of ants from Ceylon (modern-day Sri Lanka) that were "très-voisin" (very similar to) *Tapinoma*. Curiously, Motschoulsky used the name *Paratrechina* for the genus but, one paragraph later, described the first species as "*Paratrichina*" *vagabunda*—note the switch from *-trechina* to *-trichina*. He also described *Paratrichina currens*, which is now known as *Paratrechina longicornis*, the only remaining species in the genus. Although for a time *Paratrechina*, like *Nylanderia*, was placed in the genus *Prenolepis*, by 1925 it was a genus in its own right. By the mid-1980s *Paratrechina* included nearly 200 species, but all but one of these were transferred to other genera following analysis of DNA sequences and careful study of morphology.

The monotypic *Paratrechina* now includes only Motschoulsky's *P. currens*, now appropriately named *P. longicornis* for its extremely long and distinctive antennae. It is unlikely to be confused with any other species.

Paratrechina longicornis (Latreille, 1802)

*The Crazy Ant

Refers to its antennae: *longus* (Lat: long) + *cornu* (Lat: horn).

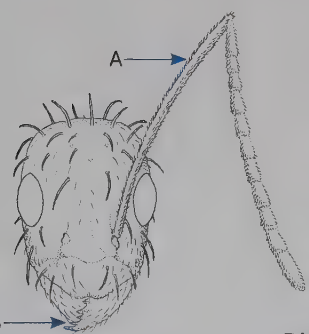


Habitat: A tropical species of disturbed areas. In temperate climes, found only inside perennially warm buildings including greenhouses and zoo buildings.

Geographic range: A worldwide tropical tramp. In New England, collected so far as we know only from one of Yale University's residential colleges in southwestern Connecticut.

Natural history: This fast and erratically running species deserves its common name.

Look-alikes: Unmistakable; no other species in our region has such long antennal scapes. The weird-looking scruffy hairs on its head also are quite distinctive.



Distinguishing features:

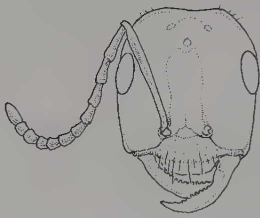
A. Scapes ≥ 1.7× head length (cf. *Nylanderia*)

B. Mandibles five toothed (cf. *Nylanderia*)

Polyergus Latreille, 1804

The Hard-working Ants

From the Greek *poly*, meaning very, much, or many, + *ergos*, meaning work



Polyergus species commonly have been called Amazon ants in reference to the mythical ancient warrior women, but they are found neither in Amazonia nor anywhere else in the tropics. Until very recently, this small genus included three Eurasian and two North American species. As we were writing this book, James Trager was revising our understanding of this genus, and he is in the process of describing at least a dozen other North American species!

Within the subfamily Formicinae, *Polyergus* species uniquely possess sickle-shaped mandibles that lack teeth, but the mandibles do have fine serrated edges on their inner border. *Polyergus* species enslave workers of a wide variety of *Formica* species, mostly in the *fusca* and *pallidefulva* groups, and to varying degrees of specificity. Our three New England species, *P. lucidus, P. montivagus,* and *P.* cf. *longicornis,* enslave *Formica incerta, F. pallidefulva,* and *F. dolosa,* respectively. These "hard-working" ants neither rear their own brood nor feed themselves; rather, they steal brood from the nests of their hosts, which mature in the *Polyergus* nest under the care of *Formica* workers already living there and doing all the usual work that keeps a colony of ants functioning. The only time hard work is done by *Polyergus* is when all of the dozens to hundreds of *Polyergus* workers in a single colony leave the nest on a highly concerted brood-pillaging excursion to a nearby host *Formica* nest. The length, pace, and efficiency of these spectacular summer afternoon raids truly are sights to behold.

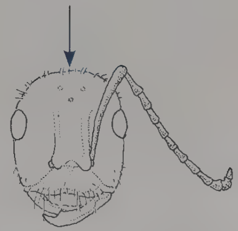
Identifying the Species of *Polyergus*

We follow Trager in recognizing three species in the New England area. The three *Polyergus* species are distinguished by the number of erect hairs on their heads: *P. montivagus* has fewer than 5, *P. lucidus* 5–10, and *P.* cf. *longicornis* at least 20. Note that the erect hairs may be lost during the adult life of the ant or after some time in a collection. However, each hair arises from a conspicuous black- or brown-rimmed socket that can be seen at 25× or greater magnification, so the hair counts mentioned in the key that follows refer to the total number of erect hairs plus the number of empty sockets. Each of our three species also enslaves only a single species in the *Formica pallidefulva* group, so it is important to collect and identify the host along with the slave-maker. As of 2011, only *P. lucidus* and *P.* cf. *longicornis* have

been collected in New England. *Polyergus montivagus* is known from Long Island (New York) and farther south.

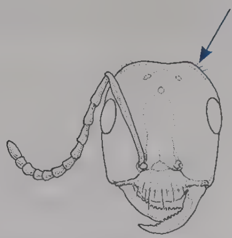
Key to the Species of *Polyergus*

1a. **The workers have ≥ 20 coarse, dark, erect hairs on the rear margin of their heads; the host is *Formica dolosa;*** this largest of our *Polyergus* species has workers usually > 6.5 mm long.. *P.* cf. *longicornis,* p. 218



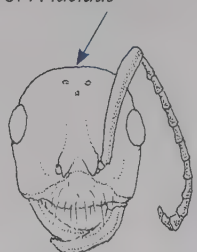
At least 20 erect hairs on the posterior margin of the head of *P.* cf. *longicornis*

1b. **The workers have < 10 erect hairs on the rear margin of their heads; these ants enslave other *Formica* species but never *F. dolosa;*** workers are usually < 6 mm long 2



Only 5–10 erect hairs on the posterior margin of the head of *P. lucidus*

2a (1b). **Workers have ≥ 5, and usually 10, erect hairs on the rear margin of their heads; this ant enslaves *F. incerta;*** its body is very shiny and its head also is usually shiny .... *P. lucidus,* p. 216



The few to no hairs on the posterior margin of the head of *P. montivagus*

2b. **Workers usually have no erect hairs, but never > 5 erect hairs, on the rear margin of their heads; this ant enslaves *Formica pallidefulva;*** its body and head have a matte (not shiny) appearance .... *P. montivagus,* p. 217

Polyergus

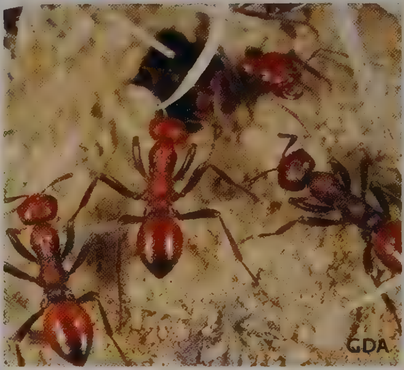
Easily Confused Species

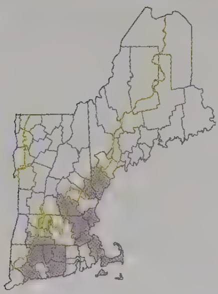
Although the red body coloration and often darker legs of *Polyergus* species are unlike the coloring of any other New England ant, they can be confused on first glance with minor workers of *Camponotus castaneus* or with their hosts in the *Formica pallidefulva* group. However, the sickle-shaped mandibles of *Polyergus* are the defining characteristic of the genus.

Polyergus lucidus Mayr, 1870

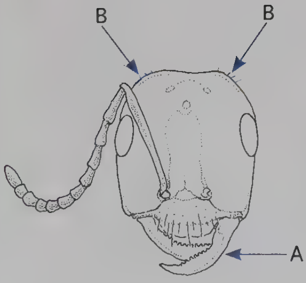
The Shiny *Polyergus*

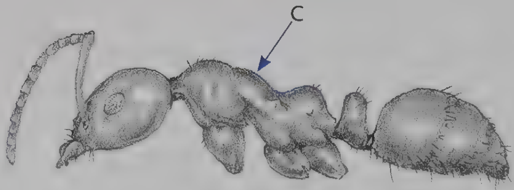
Refers to its mesosoma and gaster: *lucidus* (Lat: bright, shiny, full of light).





Habitat: Open areas such as fields, grasslands, and power line rights-of-way, nesting with its host, *Formica incerta*.
Geographic range: New England and southern Ontario south to the mountains of North Carolina; west to the prairies of Wisconsin and Missouri.
Natural history: Enslaves *Formica incerta* throughout its range. Colonies of the host greatly outnumber those of the parasite, and it is not commonly collected. Most often encountered on warm, dry summer days during its late afternoon sorties to acquire *F. incerta* brood (mostly pupae). When the slave-makers are not outside, nests may appear as unusually large, robust nests of the enslaved host, *F. incerta*.
Look-alikes: Some *Formica* species, other *Polyergus* species; sickle-shaped mandibles distinguish the genus; the number of erect hairs on the head distinguishes the species.



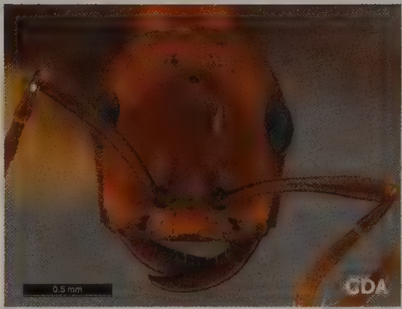


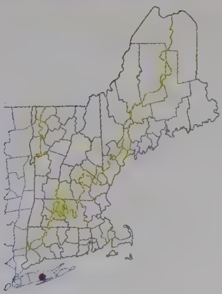
Distinguishing features:
A. Mandibles sickle-shaped, toothless (cf. *Formica* species)
B. Rear head margin with 5–10 erect hairs (cf. other *Polyergus* species)
C. Body very shiny (cf. *Polyergus montivagus*)

Polyergus montivagus Wheeler, 1915

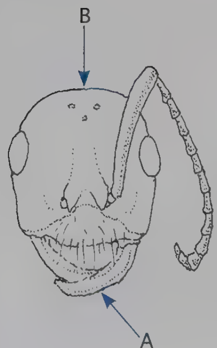
The Rambling *Polyergus*

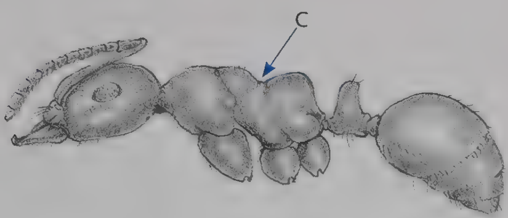
Refers to the type locality, the foothills of the Rocky Mountains: *mons* (Lat: hill) + *vagus* (Lat: wandering, rambling).





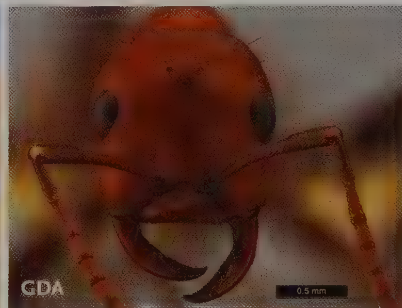
Habitat: Semi-open oak and pine-oak woodlands; nests with its host, *Formica pallidefulva*.
Geographic range: Long Island and Ontario south to northern Florida; west to Mississippi. Disjunct records from lower-elevation montane meadows of Colorado and northern New Mexico. Not yet collected in New England.
Natural history: *Polyergus montivagus* enslaves *Formica pallidefulva* throughout its range and is rarely collected. Has the smallest colonies of our 3 *Polyergus* species; the hosts greatly outnumber the slave-makers. Most often encountered on warm, dry summer days during its late afternoon raids to acquire *F. pallidefulva* brood (mostly pupae).
Look-alikes: Some *Formica* species, other *Polyergus* species; sickle-shaped mandibles distinguish the genus; the number of erect hairs on the head distinguishes the species.

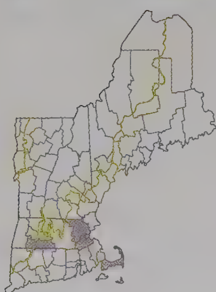




Distinguishing features:
A. Mandibles sickle-shaped, toothless (cf. *Formica* species)
B. Rear head margin with no erect hairs (cf. other *Polyergus* species)
C. Body not shiny (cf. *Polyergus lucidus*)

An undescribed species of *Polyergus* that is closely related to *Polyergus longicornis*



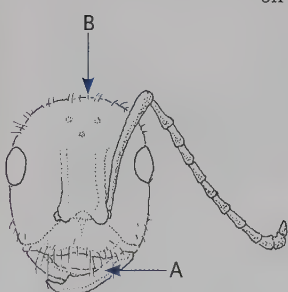


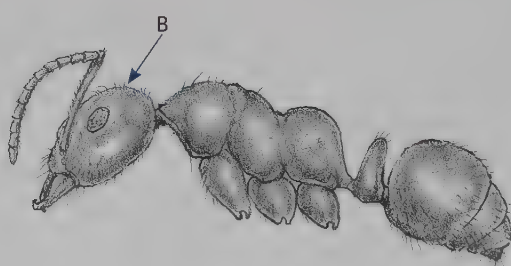
Habitat: *Polyergus* cf. *longicornis* is found in open, sandy fields, grasslands, and open woodlands, where it nests with its host, *Formica dolosa*.

Geographic range: New England to New Jersey; west to the sands of northwestern Indiana. The few New England records of this species most likely reflect earlier lumping of this species with *P. lucidus*.

Natural history: *Polyergus* cf. *longicornis* enslaves *Formica dolosa* throughout its range. Host workers greatly outnumber slave-makers in the colony. *Polyergus* cf. *longicornis* is most often encountered on warm, dry summer afternoons raiding *F. dolosa* nests for brood (mostly pupae). When the slave-makers are not out raiding colonies, you may be able to find them in what appear to be particularly large nests of its slaves, *F. dolosa*.

Look-alikes: Some *Formica* species, other *Polyergus* species; sickle-shaped mandibles distinguish the genus; the number of erect hairs on the head and antennal length distinguish the species.





Distinguishing features:

A. Mandibles sickle-shaped, toothless (cf. *Formica* species)

B. Rear head margin with ≥ 20 erect hairs (cf. other *Polyergus* species)

Prenolepis Mayr, 1861

The Ants with Drooping Petioles

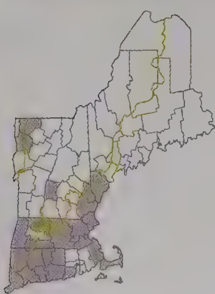
From the Greek *prenes*, meaning drooping or hanging forward, + *lepis*, meaning scale

The third and final genus in the *Prenolepis* group, the genus *Prenolepis* originally also included *Nylanderia* and *Paratrechina*. The genus was named for the characteristic forward-pointing petiole, described as "Stielchen mit einer schief nach oben und vorne gerichteten viereckigen Schuppe" (pedicel with a square scale skewed upward and forward). In North America, *Prenolepis* is separated from the other two genera in the *Prenolepis* group by its constricted promesonotum, which gives it an hourglass shape when viewed from above. Its large, compound eyes are set high on the head, unlike those of *Nylanderia* and *Paratrechina*, in which the eyes are located in the middle of the head. Currently, 35 species and subspecies are recognized within *Prenolepis*, only one of which, *P. imparis*, occurs in all of North America, including New England.

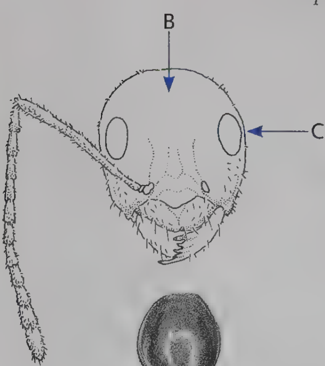
Prenolepis imparis (Say, 1836)

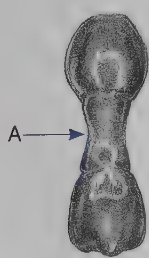
The Winter Ant

Refers to differences in color and size between queens and males: *impar* (Lat: unequal, odd).



Habitat: Open woods, old fields, field edges, and around buildings.
Geographic range: North America from southern Canada to northern Mexico.
Natural history: This is one of the first ants to become active in the spring and one of the last to disappear in the fall; because it tolerates cold temperatures, it is commonly called the Winter Ant. However, its cold-tolerance has not enabled it to extend its range into boreal climates. Feeds on nectar and other secretions from flowers and fruits; preys on arthropods; scavenges dead earthworms. Some workers can store fats in their distended abdomens; other members of the colony feed from these "repletes" during summer dormancy (estivation).
Look-alikes: *Formica lasioides, F. neogagates;* the lack of ocelli and the constricted, hourglass-shaped promesonotum (in dorsal view) identify *P. imparis.*



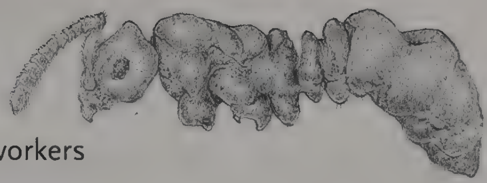


Distinguishing features:
A. Mesonotum hourglass shaped in dorsal view (cf. *Formica neogagates* and *F. lasioides*)
B. No ocelli (cf. *Formica neogagates* and *F. lasioides*)
C. Eyes set above middle of head (cf. *Nylanderia, Paratrechina*)

Anergates Forel, 1874

The Workerless Ant

From the Greek *a*, meaning without, + *ergates*, meaning workers

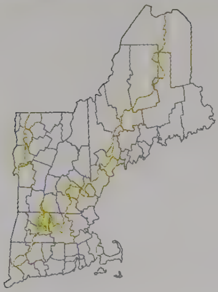


Anergates is a monotypic genus—the single described species is *A. atratulus*. It is a workerless, inquiline social parasite of the Pavement Ant, *Tetramorium caespitum:* colonies of the parasite consist of queens and males that live with and depend on the host workers for food and labor. Like its host, *A. atratulus* is native to Europe, but it has followed its host around the world. It is impossible to misidentify this genus—no other ant genus in the world more closely resembles a squashed rock lobster. The queens have a pronounced longitudinal depression on the top of the gaster, and the pupoid males are virtually indistinguishable from pupae, wingless and barely able to walk.

Anergates atratulus (Schenck, 1852)

The Small Workerless Ant

Refers to the size and color of the queens: *atratus* (Lat: dressed in black) + *-ulus* (Lat: diminutive suffix).

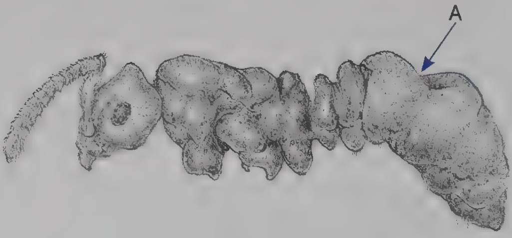


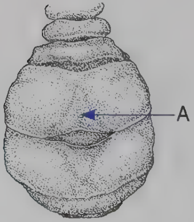
Habitat: Sidewalks, rocky outcrops, beaches, and other sandy, rocky, or dry places; nests with its host, the Pavement Ant, *Tetramorium caespitum*.

Geographic range: Worldwide; found with its host. In North America collected sporadically along the eastern seaboard; additional widely separated (disjunct) records from Ohio and Montreal, Canada. In New England, collected on Nantucket and the Boston Harbor Islands.

Natural history: Nests of *Tetramorium* that have been parasitized by *Anergates* never have *Tetramorium* queens. It is thought that *A. atratulus* colonizes only orphaned host colonies: those that have lost their queen.

Look-alikes: Unmistakable; no other ant genus has a large longitudinal depression running down the top of the gaster.





Distinguishing feature:

A. Longitudinal depression on gaster

Anergates

Aphaenogaster Mayr, 1853

The Dull-gastered Ants

From the Greek *aphanes*, meaning unseen, invisible, or obscure, + *gaster*, the end of the abdomen

Aphaenogaster is a diverse genus of ants; the more than 225 species in this genus are distributed around the world. It was named for its dull (not shiny) gaster, but note that our North American *Aphaenogaster* species have shinier gasters than European ones. It was originally described as being similar to ants of the tropical leaf-cutter genus *Atta*. It is easily recognized in our region by its prominently depressed propodeum, and we often refer to it as the "broke-backed ant" because its distinctive stepped-down profile gives the impression of a broken back. There are about 40 species in North America, six of which are present in New England. The three New England *Aphaenogaster* species in the *rudis* species group are important seed dispersers of many of our spring ephemerals: woodland herbs such as Bloodroot (*Sanguinaria canadensis*) and Wake-robin (*Trillium* species) that flower in early spring before the canopy trees leaf out.

Identifying the Species of *Aphaenogaster*

Three of the six New England species of *Aphaenogaster* are distinctive and easy to identify, whereas the other three look very similar to one another. First, the easy ones. *Aphaenogaster treatae* is a very large ant with a pronounced lobe at the base of its antennal scape. *Aphaenogaster mariae* is nearly as large as *A. treatae*, and it has long, distinct lines or grooves (striae) that radiate out in a sunburst pattern from the postpetiole onto the anterior part of the first segment of its gaster. This species also has a very long face, long propodeal spines, and coarse sculpturing on its head and mesosoma. Finally, *A. tennesseensis* is virtually hairless and has propodeal spines that are as long as or longer than the distance that separates them.

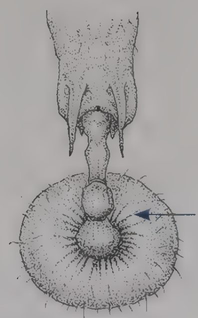
The other three New England species of *Aphaenogaster* often have been lumped into "*Aphaenogaster rudis*," but careful measurements and a fine eye for detail have begun to separate this group into at least three species. The New England species of "*A. rudis*"—*A. fulva*, *A. picea*, and *A. rudis* itself—are distinguished by the color of the four terminal segments of their antennae, the shape and size of the top (peak) of the mesonotum, the height of this mesonotal peak relative to the pronotum, and the size of their propodeal spines. The antennal segments are uniformly colored in *A. rudis;* the peak of the mesonotum of these ants is rounded and not higher than the

top of the pronotum, and their propodeal spines are short, upwardly pointed, and less than half as long as the length of the sloping face of the propodeum. The last four segments of the antennae of *A. fulva* and *A. picea* species are much lighter than the remaining segments (including the scape). *Aphaenogaster fulva* has the highest and sharpest mesonotal peak of these species in this species group, and the propodeal spines are as long as the length of the sloping face of the propodeum. The propodeal spines of *A. picea* are somewhat longer than those of *A. rudis*—about two-thirds as long as the length of the sloping face of the propodeum—and they point rearward, not upward. Befitting its name, *A. picea* is quite dark, whereas *A. rudis* is much redder. Finally, systematic studies by Bernice DeMarco are revealing that what we now refer to as *A. rudis* and *A. picea* will each turn out to be complexes of subtly varying sibling species. DNA sequences will most likely be necessary to disentangle the taxonomy of this genus in North America.

The matrix key above illustrates three morphological characters that can be used to quickly determine which species of *Aphaenogaster* you have. Each species is shown in profile; the size shown is approximately six times the size of a worker, and the colors illustrate differences, ranging from orange-red to dark brown. The species are ordered by size, from largest to smallest. The principal characteristics to look for include sculpturing, antennal shape and color, the shape of the mesonotum, its height at the peak relative to the top of the pronotum, and the size and orientation of the spines. The mesonotum peaks well above the pronotum, and the long propodeal spines are directed upward in the reddish-yellow *A. fulva*. The mesonotum barely projects above the pronotum, and the intermediate-length propodeal spines

point rearward in the dark brown *A. picea*. The mesonotal peak does not exceed the height of the pronotum in the remaining four species. The small *A. rudis* is reddish brown, sometimes appearing nearly purple in the field, and has small, upward-pointing spines. The larger, reddish-brown, and uniquely hairless *A. tennesseensis* has very long propodeal spines; the very large, orange-red *A. treatae* has short propodeal spines; and *A. mariae* has coarse sculpturing on its head and mesosoma. *Aphaenogaster treatae* is the only species in our region with a large lobe at the base of the scape. The last four antennal segments are lighter in color in *A. fulva* and *A. picea*, whereas the antennal segments are uniformly colored in *A. rudis*.

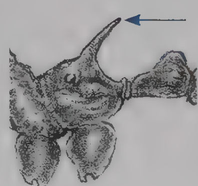
Key to the Species of *Aphaenogaster*



Starburst striae on the gaster of *A. mariae*

1a. **The 1st gastral tergite has long, distinct lines or grooves (striae) that radiate in a sunburst pattern from the post-petiole**; the head and mesosoma are coarsely sculptured with dense, anastomosing ridges (rugae); the propodeal spines are very long—at least as long as the distance between their tips .... *A. mariae*, p. 229

1b. **The 1st gastral tergite lacks striae**; the sculpturing on the head and mesosoma is fine; the propodeal spines normally are not longer than the distance between their tips, but if they are, the mesosoma and gaster are hairless 2



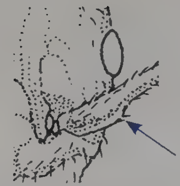
Very long propodeal spines of *A. tennesseensis*

2a (1b). **The cheeks, as well as the dorsum of the mesosoma and the gaster, are hairless**; the propodeal spines are very long—at least as long as the distance between their tips ... . *A. tennesseensis*, p. 232

2b. **The cheeks, mesosoma, and gaster have many erect hairs**; the propodeal spines are normally not longer than the distance between their tips..3

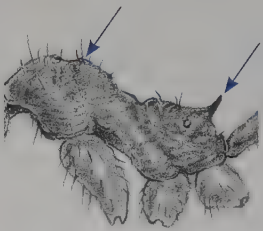
Aphaenogaster

3a (2b). **Base of antennal scape with a wide, thick lobe** extending about one-fourth the length of the scape .... *A. treatae*, p. 233

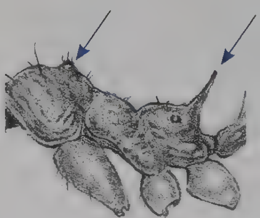

Flange at the base of the antennal scape of *A. treatae*

3b. **Base of antennal scape without a lobe** 4

4a (3b). **The last four segments of the antennae are the same color as the remaining segments**; the propodeal spines are short—not more than half the length of the propodeal declivity (rear-sloping face)—and pointed upward; the top (peak) of the mesonotum is not higher than the top of the pronotum .... *A. rudis* (species complex), p. 231

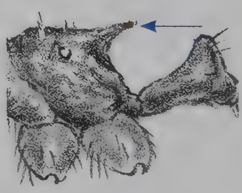

Short propodeal spines and low-peaked mesonotum of *A. rudis*

4b. **The last four segments of the antenna are paler (lighter in color) than the remaining segments**; the propodeal spines are at least two-thirds the length of the propodeal declivity and pointed either upward or toward the rear; the top (peak) of the mesonotum is as high as or higher than the top of the pronotum 5


Longer propodeal spines and high-peaked mesonotum of *A. fulva*

5a (4b). **Propodeal spines long**—at least as long as the propodeal declivity—and **point upward**; the ant's color is reddish-brown......... *A. fulva*, p. 228

5b. **Propodeal spines shorter**—approximately two-thirds the length of the propodeal declivity —**and point toward the rear**; the ant's color is dark brown or blackish brown .... *A. picea* (species complex), p. 230


Rearward-pointing propodeal spines of *A. picea*

Aphaenogaster

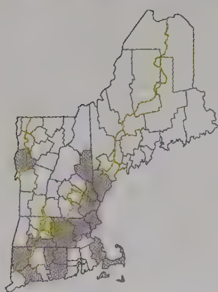
Easily Confused Species

Although the characteristic broken-back profile of the promesonotum of *Aphaenogaster* is a good starting point for recognizing this genus, it is possible to confuse it with the similarly shaped, but much smaller, *Pheidole*. This is not surprising, because *Aphaenogaster* and *Pheidole* are closely related genera, currently placed in the tribe Pheidolini. However, *Aphaenogaster* workers are generally all the same size, whereas *Pheidole* has large majors and small minors, which both have disproportionately large heads (most apparent in the major workers). *Pheidole* also has a distinct three-segmented antennal club, whereas *Aphaenogaster* has, at best, only an indistinct antennal club consisting of at least four segments.

Aphaenogaster fulva Roger, 1863

The Tawny *Aphaenogaster*

Refers to its color: *fulvus* (Lat: tawny, reddish yellow).

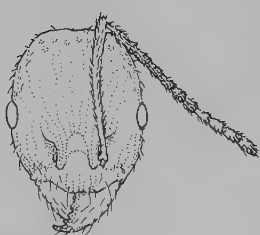


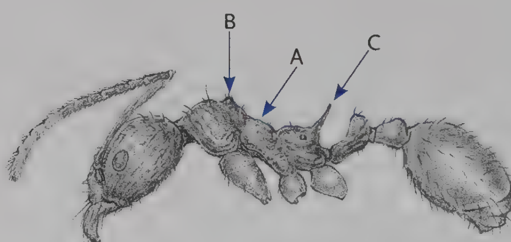
Habitat: Moist or dry deciduous forests; nests in rotten logs and old tree stumps.

Geographic range: Vermont south to Florida; west to the Midwestern prairie states; south to Louisiana. Its apparent rarity in New England is likely due to specimens' being confused with other *Aphaenogaster rudis*-group species.

Natural history: An important disperser of violet (*Viola* species) seeds. After eating the nutritious elaiosome, *A. fulva* discards the seeds. Colonies may host the temporary social parasite, *A. tennesseensis*, and also host larvae of the myrmecophilous hoverfly, *Microdon coarctatus*.

Look-alikes: *Aphaenogaster picea, A. rudis;* the height of the mesonotal peak, the size and direction of the propodeal spines, and the color of the last 4 antennal segments distinguish them.





Distinguishing features:

A. Mesonotum sharply sloped (cf. other Myrmicinae)

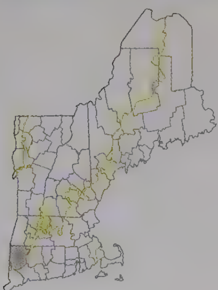
B. Mesanotal peak raised above pronotum (cf. *A rudis*)

C. Propodeal spines point upward, >0.5× declivity length (cf. *A. picea, A. rudis*)

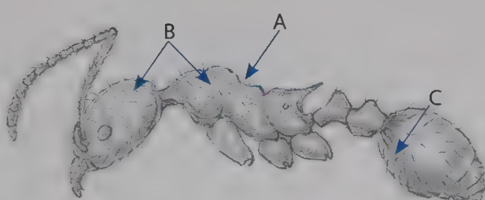
Aphaenogaster mariae Forel, 1886

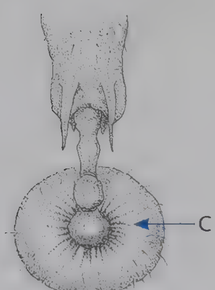
Mary's *Aphaenogaster*

Honors its collector, Mary Lua Adelia Davis Treat (1830–1923), a naturalist and correspondent of Charles Darwin.



Habitat: Canopies of oaks and other hardwood species.
Geographic range: Connecticut south to Florida; west to Michigan, Iowa, Kansas.
Natural history: Rarely seen or collected because of its propensity for nesting in treetops, but thought to be a temporary social parasite of *A. fulva*. Our single New England specimen was collected in 1906 by William Wheeler in northwestern Connecticut. You may find it if you put peanut butter bait on the trunk of a large oak tree and wait an hour or so for foragers to find the bait.
Look-alikes: *Aphaenogaster tennesseensis;* Forel described *A. mariae* as "très voisin du tennesseensis et exactement de la même couleur" (very similar to *tennesseensis* and exactly the same color), but the starburst pattern of striae on the first gastral tergite of *A. mariae* is unique.





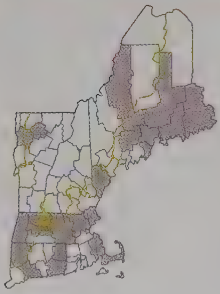
Distinguishing features:
A. Mesonotum sharply sloped (cf. other Myrmicinae)
B. Head, mesosoma coarsely sculptured
C. First gastral tergite with radial striae

Aphaenogaster

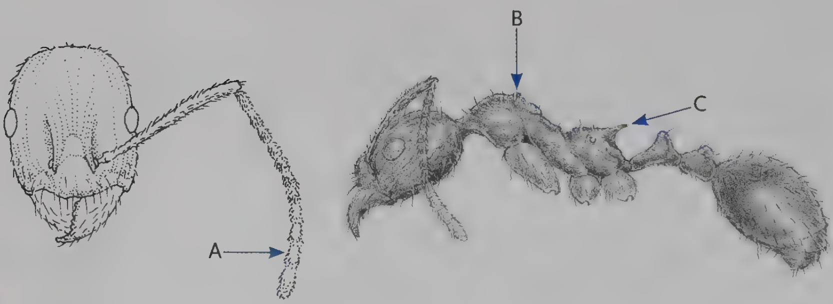
Aphaenogaster picea (Wheeler, 1908)

The Pitch-black *Aphaenogaster*

Refers to its color and habitat: *piceus* (Lat: pitch black; also means spruce).



Habitat: Moist conifer forests and mixed deciduous forests; nests in damp habitats such as rotten logs or old tree stumps, under bark and fallen tree limbs, and in small cavities.
Geographic range: Southern Canada and New England; south to Georgia; west to Ohio. Its apparent rarity in southern New England is likely due to confusion of this species with *A. rudis*.
Natural history: An omnivorous scavenger and an important disperser of seeds of woodland herbs. Host to the temporary social parasite *A. tennesseensis*.
Look-alikes: *Aphaenogaster fulva, A. rudis;* the height of the mesonotal peak, the size and direction of the propodeal spines, and the color of the last 4 antennal segments distinguish them. Ongoing genetic work suggests that "*A. picea*" is likely a complex of several closely related species.



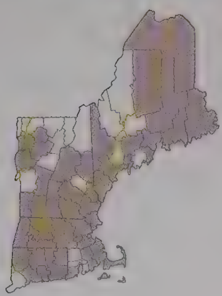
Distinguishing features:
A. Last 4 antennal segments lighter than others (cf. *A. rudis*)
B. Mesanotal peak slightly raised over pronotum (cf. *A. fulva, A. rudis*)
C. Propodeal spines point rearward, 0.5× declivity length (cf. *A. rudis*)

Aphaenogaster

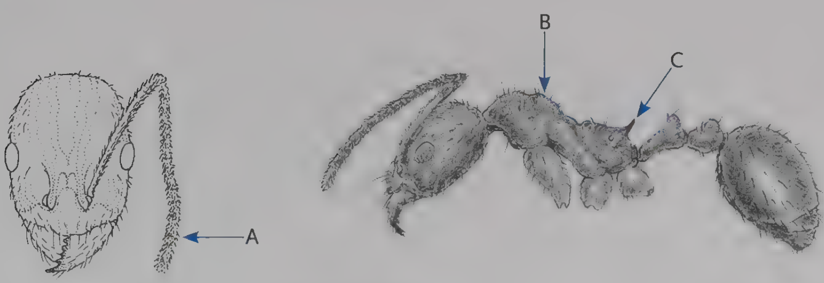
Aphaenogaster rudis Enzmann, 1947

The Rough *Aphaenogaster*

Refers to its sculptured mesosoma: *rudis* (Lat: rough).



Habitat: Forests and woodlands; nests in rotten logs and old tree stumps and under bark, fallen tree limbs, and rocks.
Geographic range: Southern Canada and New England; south to Alabama; west to Missouri.
Natural history: An omnivorous scavenger and an important disperser of seeds of many woodland herbs. Host to the temporary social parasite *A. tennesseensis*.
Look-alikes: *Aphaenogaster fulva, A. picea;* the height of the mesonotal peak, the size and direction of the propodeal spines, and the color of the last 4 antennal segments distinguish them. Ongoing genetic work suggests that "*A. rudis*" is likely a complex of several closely related species.



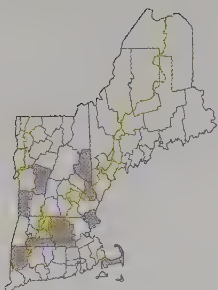
Distinguishing features:
A. Last 4 antennal segments same color as others (cf. *A. picea*)
B. Mesonotal peak not raised above pronotum (cf. *A. fulva*)
C. Propodeal spines point upward, < 0.5× declivity length (cf. *A. picea*)

Aphaenogaster tennesseensis (Mayr, 1862)

The Tennessee *Aphaenogaster*

Named for its type locality, Tennessee.

AW

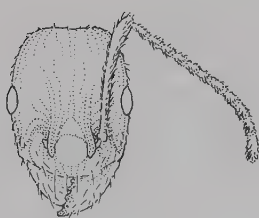


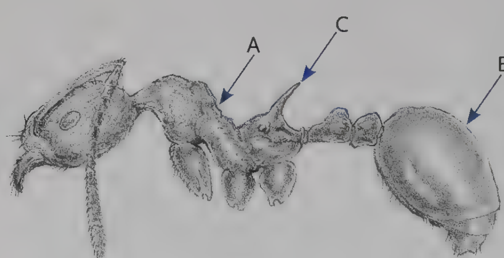
Habitat: Forests and woodlands; nests in standing dead trees, rotten logs, old tree stumps, occasionally fallen tree limbs.

Geographic range: Quebec south to Florida; west to Oklahoma. Only a dozen records from all of New England.

Natural history: Thought to be a temporary social parasite of *A. fulva*, *A. picea*, *A. rudis*. Makes very large colonies (2,000–5,000 ants). Workers forage on long scent trails along logs and up trees. More carnivorous than other New England *Aphaenogaster* species; it even hunts isopods.

Look-alikes: Unmistakable; nearly hairless and with very long propodeal spines. Unusually, queens are about the same size as workers.





Distinguishing features:

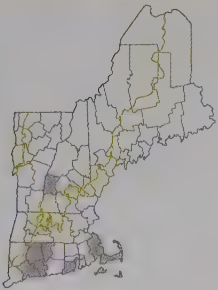
A. Mesonotum sharply sloped (cf. other Myrmicinae)
B. Mesosoma, gaster hairless
C. Propodeal spines very long

Aphaenogaster

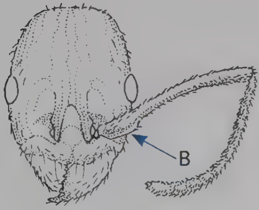
Aphaenogaster treatae Forel, 1886

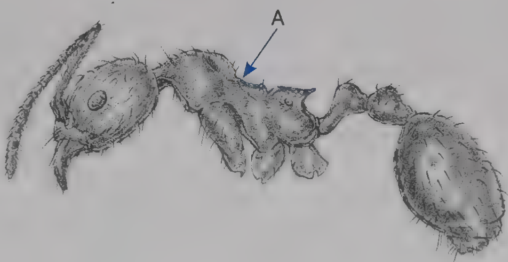
Treat's *Aphaenogaster*

Honors its collector, Mary Lua Adelia Davis Treat (1830–1923), an economic entomologist and evolutionary biologist.



Habitat: Sandy soils in warm, open habitats—grasslands, heathlands, pine barrens; nests in soil at the base of plants and under rocks.
Geographic range: Ontario and the Canadian Maritime Provinces; south to Florida; west to Michigan, Illinois.
Natural history: The most common *Aphaenogaster* collected on Cape Cod and the Massachusetts islands of Martha's Vineyard and Nantucket. It feeds on insects and seeds.
Look-alikes: Unmistakable; very large and with a broad lobe at the base of its scape.





Distinguishing features:

A. Mesonotum sharply sloped (cf. other Myrmicinae)

B. Antennal scape with large basal lobe

Aphaenogaster

Cardiocondyla Emery, 1869

The Ants with Heart-shaped Postpetioles

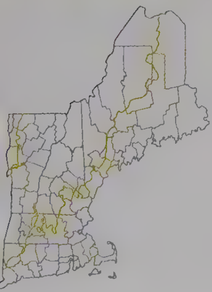
From the Greek *cardia,* meaning heart, + *cóndulos,* meaning knuckle and referring to the vaguely heart-shaped postpetiole

The genus *Cardiocondyla* includes 68 species of very tiny ants. The Holarctic species, including many tropical tramps, were reviewed and revised in 2003, but much less is known about the tropical species. *Cardiocondyla* is distinguished from other Myrmicinae by its clypeus, which often extends well over the mandibles; a prominent erect hair in the middle of its clypeus; a very wide, heart-shaped (in dorsal view) postpetiole; and the absence of erect hairs on its mesosoma. It can be confused with *Temnothorax, Leptothorax, Stenamma,* or *Tetramorium,* but ants in all of these genera have erect hairs on their mesosoma and are generally larger than *Cardiocondyla.* Only one species, the tropical tramp *C. obscurior,* has been recorded from New England.

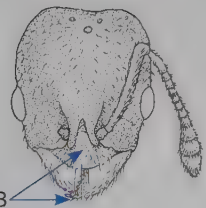
Cardiocondyla obscurior Wheeler, 1929

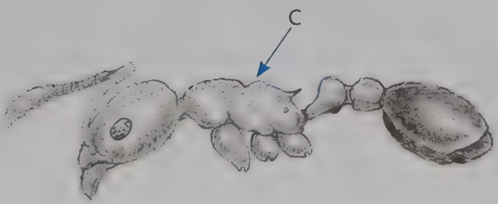
The Dark *Cardiocondyla*

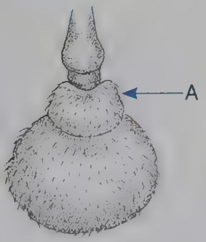
Refers to the color of its gaster: *obscurus* (Lat: dark).



Habitat: This tropical tramp nests in soil. In New England it can survive only inside heated buildings, such as greenhouses.
Geographic range: Worldwide in the tropics and subtropics; so far collected in New England only from a greenhouse in Boston.
Natural history: Forms polygynous colonies with long-lived, dimorphic males: winged or workerlike (ergatandrous). Ergatandrous males fight and kill each other within the nest, so that only a single male can mate with the many queens produced by the colony. Because *Cardiocondyla* individuals are very tiny, and the colonies themselves are small and often hidden in soil, packing material, or plants, they can be missed by customs inspectors and spread easily into new areas.
Look-alikes: *Formicoxenus, Harpagoxenus, Leptothorax, Protomognathus, Temnothorax;* of these, only *Cardiocondyla* has a heart-shaped postpetiole (viewed dorsally) and lacks erect hairs on its body.

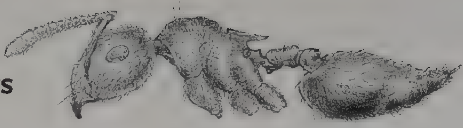






Distinguishing features:
A. Postpetiole heart shaped
B. Clypeus large, with a long, median hair
C. Mesosoma without erect hairs

Cardiocondyla



Crematogaster Lund, 1831

The Ants with Suspended Gasters

From a misspelling of the Greek *kremastos,* meaning hanging, + *gaster,* the end of the abdomen

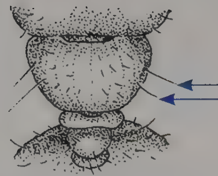
Crematogaster is a very large and diverse genus of ants. Nearly 800 valid species have been described, at least 30 of which occur in North America, but so far only two species are known from New England. It is impossible to mistake this genus for any other. As Peter Wilhelm Lund wrote in describing the genus, "Ce genre est caractérisé . . . mais surtout par l'insertion du pédicule au milieu de la surface supérieure de l'abdomen" (This genus is characterized . . . especially by the insertion of the postpetiole in the middle of the upper surface of the gaster). We suspect that the gaster suspended from the postpetiole provided Lund with the genus name, but that he dropped an *s:* the Greek word *kremastos* means suspended or hanging. The unique articulation of the petiole and postpetiole to the gaster allows the ant to flex its gaster up and over its back, pointing the stinger forward in a defensive posture. Despite this rather menacing behavior, the spatula-shaped stinger is not designed to penetrate potential attackers. Rather, the stinger simply secretes a noxious-smelling liquid that repels enemies. The drop of liquid secreted by the stinger drips onto the many hairs on the ant's mesosoma, adding smelly insult to the visual injury.

Identifying the Species of *Crematogaster*

The two New England species of *Crematogaster* are distinguished by the hairiness of the pronotum. *Crematogaster cerasi* has one or two long, erect hairs on each corner (shoulder) of the pronotum, whereas *C. lineolata* has short, erect hairs across the entire pronotum.

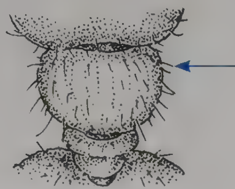
ey to the Species of *Cremategaster*

. **No erect hairs on the mesosoma except for 1–2 pairs of erect hairs on the corners of the pronotum**............*C. cerasi*, p. 238



In dorsal view, *C. cerasi* has one or two pairs of long, erect hairs on the corners of its pronotum.

. **Many (8–20) short hairs on the pronotum** and scattered elsewhere on the mesosoma .... *C. lineolata*, p. 239



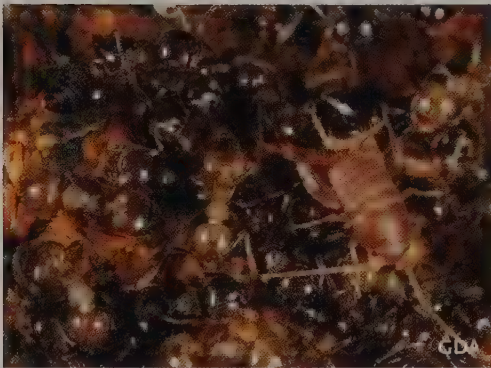
In dorsal view, *C. lineolata* has smaller erect hairs all over its pronotum.

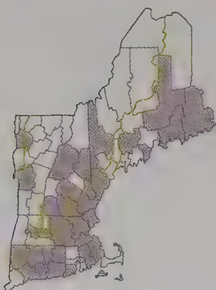
Crematogaster

Crematogaster cerasi (Fitch, 1855)

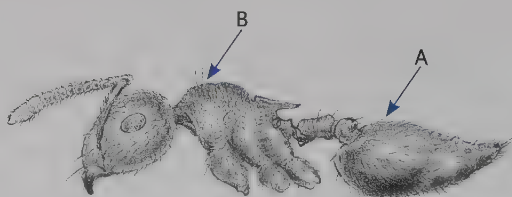
The Cherry Ant

Refers to the tree on which it was first found, tending aphids: *cerasus* (Lat: cherry).

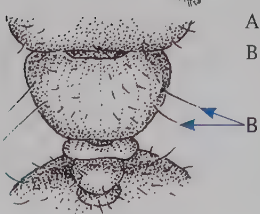




Habitat: Nests in large rotten logs in open fields, at the edges of woods, and in woodlands. May also nest in wooden frames of houses.
Geographic range: Eastern North America from Quebec to Florida; west to the Rocky Mountains; south to New Mexico.
Natural history: Forms enormous colonies (10,000 or more ants) with workers that forage on long scent trails. Collects seeds and dead insects and tends aphids for honeydew; described by Asa Fitch as a tender of "plant-lice" of cherry trees (hence its scientific name) in New York State. Nests of *C. cerasi* are often inhabited by crickets in the aptly named genus *Myrmecophilus* ("ant lover").
Look-alikes: *Crematogaster lineolata;* 1–2 erect hairs at the corners of the pronotum identify *C. cerasi.*



Distinguishing features:
A. Gaster heart shaped, suspended
B. Corners of pronotum with 1–2 erect hairs (cf. *C. lineolata*)

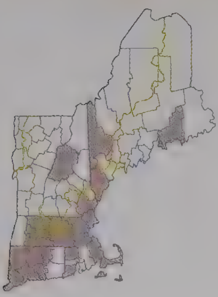


Crematogaster

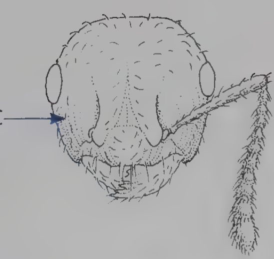
Crematogaster lineolata (Say, 1836)

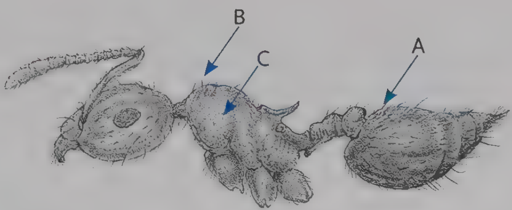
The Small-lined *Crematogaster*

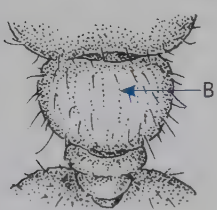
Refers to the rugae on top of its mesosoma: *lineola* (Lat: small-lined).



Habitat: Open fields, forest edges, open shrublands, power line rights-of-way, houses. Nests in soil, under rocks, in and under dead wood, at the base of grass clumps.
Geographic range: Eastern North America from Quebec to Florida; west to the Great Plains.
Natural history: Colonies of *C. lineolata* are large (1,000–10,000 workers) and polygynous. Workers occasionally build covered chambers out of plant debris or mud, called "cow sheds," on the sides of plant stems. *Crematogaster lineolata* houses aphids and other Homoptera inside these sheds, where the ants tend these tiny livestock for honeydew.
Look-alikes: *Crematogaster cerasi;* many erect hairs across the pronotum identify *C. lineolata.*







Distinguishing features:
A. Gaster heart shaped, suspended
B. Pronotum with many erect hairs (cf. *C. cerasi*)
C. Head and body with fine striae

Formicoxenus Mayr, 1855

The Guest Ants

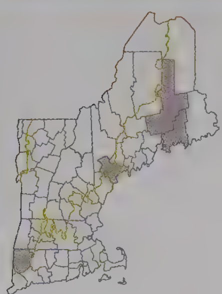
From the Latin *formica*, meaning ant, and the Greek *xenos*, meaning guest or stranger and referring to their habit of living in the nests of other ants

The genus *Formicoxenus* is a very small genus of ants with only seven valid species spread around the Northern Hemisphere. The genus was thoroughly revised in 1985 as part of a broader analysis of ants in the tribe Leptothoracini (which includes our genera *Formicoxenus, Harpagoxenus, Leptothorax, Protomognathus,* and *Temnothorax*). Ants in this genus are readily identified by the many short, erect hairs poking out from between the facets of their compound eyes. Of the five Nearctic species, only one, *F. provancheri,* is currently known from New England.

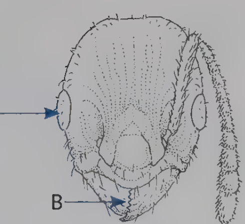
Formicoxenus provancheri (Emery, 1895)

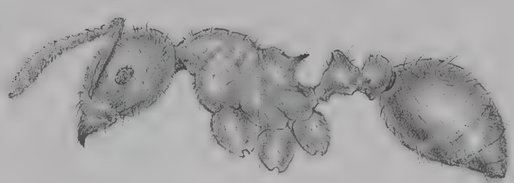
Provancher's *Formicoxenus*

Named for L'Abbé Léon Provancher (1820–1892), who first described this species (albeit as *Myrmica tuberum*).



Habitat: Nests in bogs and fens with or near its host, *Myrmica incompleta*.
Geographic range: Northern North America from Quebec and Maine west to North Dakota; high elevations in Colorado and New Mexico.
Natural history: A trophic or xenobiotic social parasite that takes food from the mouths of its hosts, *Formicoxenus* makes small colonies (<100 workers) in the walls of its host's nests. Although *Formicoxenus* raises its own brood, it depends on its host for food and shelter.
Look-alikes: *Cardiocondyla, Harpagoxenus, Leptothorax, Protomognathus, Temnothorax;* only *Formicoxenus* has distinctive erect hairs emerging from its compound eyes.



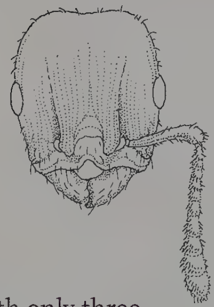


Distinguishing features:
A. Erect hairs protruding from between ommatidia
B. Mandibles with 5–6 teeth (cf. *Harpagoxenus, Protomognathus*)

Harpagoxenus Forel, 1893

The Robber Guest Ants

From the Greek *harpaxo*, meaning robber, + *xenos*, meaning guest or stranger and referring to their raiding and slave-making habits

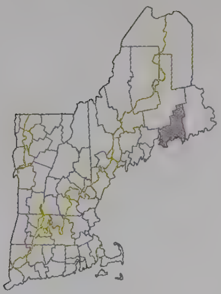


The genus *Harpagoxenus* is a very small genus of ants with only three recognized species that range throughout the Northern Hemisphere. Only one species, *H. canadensis,* occurs in North America (and New England). Although originally named *Tomognathus* by Gustav Mayr in 1861, that name had been used in 1850 to name another genus—of fossil fish—so the rules of nomenclature demanded a new name, which Auguste-Henri Forel supplied in 1893. Ants in the genus *Harpagoxenus* are easily recognized by the pronounced grooves (scrobes) on either side of the frontal lobes in which the antennae nestle, and by the lack of teeth on their mandibles. *Harpagoxenus* species raid and enslave ants in the genus *Leptothorax.*

Harpagoxenus canadensis Smith, 1939

The Canadian *Harpagoxenus*

Named for its type locality, Quebec, Canada.

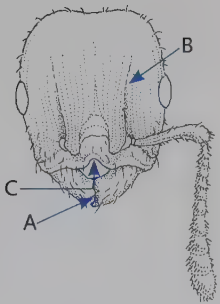


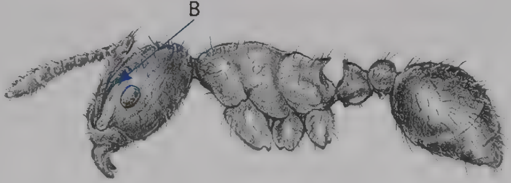
Habitat: Nests in rotten wood and under bark near its hosts, two undescribed species of *Leptothorax*.

Geographic range: Northern North America, including the Canadian Maritime Provinces, Quebec, Maine, Michigan, and Minnesota; a single record from southwest Colorado. Collected in New England from only two localities in coastal Down East Maine.

Natural history: Raids colonies of its hosts (*Leptothorax* sp. AF-can and *L.* sp. AF-erg). It then kills the queen, and carries off brood to rear as slaves in its own nest.

Look-alikes: *Cardiocondyla, Formicoxenus, Leptothorax, Protomognathus, Temnothorax; Harpagoxenus* lacks mandibular teeth and has pronounced antennal scrobes and a deeply notched clypeus.





Distinguishing features:

A. Mandibles lack teeth (cf. *Formicoxenus, Protomognathus*).

B. Antennal scrobes pronounced (cf. *Leptothorax, Temnothorax*)

C. Clypeus deeply notched

Leptothorax Mayr, 1855

The Thin Ants

From the Greek *leptos*, meaning thin or fine + *thorax*, referring to the mesosoma of the ant

Once considered a hyperdiverse genus with over 500 species, *Leptothorax* now has been reduced to only 20 or so species; nearly 400 of the others have been transferred to *Temnothorax* and the remainder placed in at least eight other genera. *Leptothorax* is a cool-climate, almost boreal genus with representatives throughout the Northern Hemisphere. In North America there are at least 10 species in 2 species groups, the *muscorum* group and the *acervorum* group. We have recorded 3 species from New England, all of which are in the *muscorum* group; 2 of these species are being assessed and taxonomically revised by Professor André Francoeur, and we refer to the species using his standard abbreviations for them. Another 2, one in each species group, have been documented from nearby Quebec and are included in this guide. *Leptothorax* is named for its slender, tapering mesosoma, but we recognize it by its six-toothed mandibles (except for *L. wilsoni*), its relatively small size (our most common species, *L.* sp. AF-can, is just over 4 mm long, but the other 4 species are only 2.5–3 mm long), its broadly triangular petiole, and a light impression or suture along its mesonotum.

Identifying the Species of *Leptothorax*

Only one of the five species of *Leptothorax* we discuss—the undescribed *L.* sp. AF-can—is especially common in New England. It is the largest of our *Leptothorax* species—workers are at least 4 mm long—and its dark brown to black color is distinctive. In recent literature, *L.* sp. AF-can has been referred to variously as "Species B," "*muscorum*" or "*muscorum*-group," or even "large brown" or "large black." A second undescribed species, *Leptothorax* sp. AF-erg, has recently been separated from *L.* sp. AF-can based on the presence of a pronounced toothlike process on the bottom of its postpetiole. *Leptothorax* sp. AF-erg is also smaller (workers approximately 2.7 mm) and lighter brown in color. In the scientific literature, *L.* sp. AF-erg has been called "Species A" or "small brown" to distinguish it from *L.* sp. AF-can. *Leptothorax wilsoni* is an inquiline social parasite of *L.* sp. AF-can; its single-toothed mandibles distinguish it from all our other *Leptothorax* species. The last two species have simple characters that distinguish them from the others: *L. retractus* has a deeply notched clypeus, and *L. sphagnicola* has many erect hairs on its antennae, which is also a defining character-

istic of the *acervorum* group. *Leptothorax sphagnicola* was originally named *L. sphagnicolus*, but the species name was changed because *sphagnicola* is a noun modifying another noun (*Leptothorax*)—that is, it is a noun in apposition—hence the ending does not have to agree (in gender) with that of the genus name. Indeed, the rules for naming new species are complex and arcane! Both *L. retractus* and *L. sphagnicola* have been collected in Quebec, but are not yet known from New England. If members of either of these species are here, they will most likely be found in northern Maine or on the high peaks of New Hampshire's White Mountains or Vermont's Green Mountains.

This matrix key illustrates seven morphological characters that can be used to separate the five New England and eastern Canadian species of *Leptothorax*. Each species is shown in profile; the size shown is approximately 10 times the size of a worker, and the colors illustrate differences ranging from dark brown to light brownish-yellow. The species are ordered by size, from largest to smallest. The primary characters to look for on the head are the presence or absence of a notched clypeus, whether the antennae have numerous erect hairs, and the number of teeth on the mandible. *Leptothorax retractus* is the only New England species with a notched clypeus, *L. sphagnicola* is the only New England species with many erect hairs on its antennae, and *L. wilsoni*, with its single-toothed mandible, is the only New England species of *Leptothorax* without six teeth on its mandibles. The two remaining species, *L.* sp. AF-can and *L.* sp. AF-erg, are separated by their size and color, the length of the erect hairs on the mesosoma, and the presence or absence of a visible process on the lower surface of the

Leptothorax AF-can

Leptothorax wilsoni

Leptothorax AF-erg

Leptothorax retractus

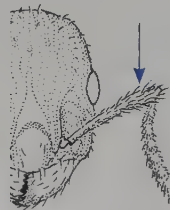
Leptothorax sphagnicola

postpetiole. *Leptothorax* sp. AF-can is larger (workers more than 4 mm long) and dark brown to black in color, has short (under 0.04 mm) erect hairs on its mesosoma, and has no process on the bottom of its postpetiole. In contrast, *L.* sp. AF-erg is small (workers under 3 mm long) and light brown in color, has longer (over 0.07 mm) erect hairs on its mesosoma, and has a distinct toothlike process on the bottom of its postpetiole.

Key to the Species of *Leptothorax*

1a. **Numerous erect hairs on the antennal scapes and tibiae**; this is a species of boreal bogs .... *L. sphagnicola*, p. 249

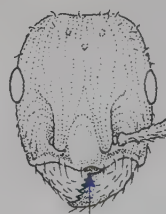
1b. **Erect hairs absent on antennal scapes or tibiae**; these are species of wooded or open habitats, rarely bogs 2



Erect hairs on the scape of *L. sphagnicola*

2a (1b). **Clypeus deeply notched**; queens very small; this ant is most common in boreal forests but extends its range into the boreal-temperate transition zone, especially in stands dominated by Jack Pine (*Pinus banksiana*) .... *L. retractus*, p. 248

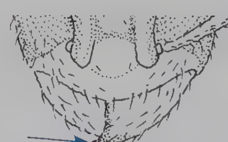
2b. **Clypeus not notched** 3



Notched clypeus of *L. retractus*

3a (2b). **There are 6 teeth clearly visible on the mandibles of workers and queens**; lower surface of the postpetiole with or without a prominent tooth.................. 4

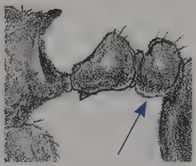
3b. **Only 1 tooth (an apical one) is present on the mandibles of the queens**; the lower surface of the postpetiole has a prominent tooth; any workers (with 6 teeth) that are present in the colony are those of this species' host, *L.* sp. AF-can ....*L. wilsoni*, p. 250



Single-toothed mandible of *L. wilsoni*

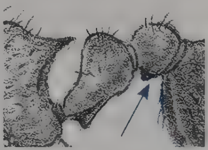
Leptothorax

4a (3a). **A dark brown to black ant with short (<0.04 mm) hairs on the mesosoma**; no anterior process is visible on the lower surface of the postpetiole; a widespread species in northeastern woodlands. .... *L.* sp. AF-can, p. 251



Smooth postpetiole of *L.* sp. AF-can

4b. **A light brown to brown ant with long (>0.07 mm) hairs on the mesosoma;** the anterior process is visible on the lower surface of the postpetiole; a relatively uncommon species of dry open or disturbed woodlands .... *L.* sp. AF-erg, p. 252



Toothlike process under the postpetiole of *L.* sp. AF-erg

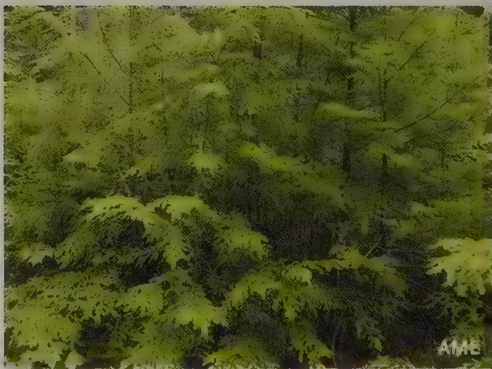
Easily Confused Species

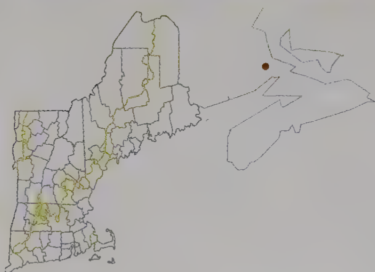
Leptothorax is easily confused with *Temnothorax*. Both genera in our region have 11-segmented antennae (except for *T. texanus,* which has 12-segmented antennae). *Leptothorax* usually has six teeth on its mandibles and a petiole without an obviously lengthened peduncle, whereas *Temnothorax* has only five teeth on its mandibles and a petiole with a pronounced, elongate peduncle.

Leptothorax retractus Francoeur, 1986

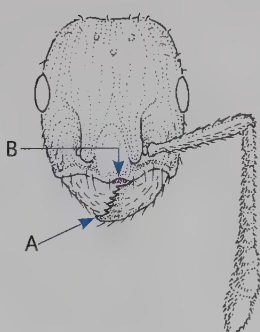
The Notched *Leptothorax*

Refers to its notched clypeus: *retractus* (Lat: drawn back).





Habitat: Boreal forests; nests in dead wood on the soil surface or in wood that has been partially buried.
Geographic range: Canada—Yukon, Alberta, Ontario, Quebec, New Brunswick—and Utah. There are no known records of this species in New England, but it may occur at high elevations in the White Mountains of New Hampshire or the Green Mountains of Vermont. Because this species often nests in stands of Jack Pine (*Pinus banksiana*), it might also be collected in the coastal bogs of coastal Down East Maine.
Natural history: Makes small, monogynous colonies (±50 workers). When given a choice, the slave-maker *Harpagoxenus canadensis* avoids this species in favor of *L.* sp. AF-can.
Look-alikes: Other *Leptothorax* species; the deeply notched clypeus distinguishes *L. retractus*.

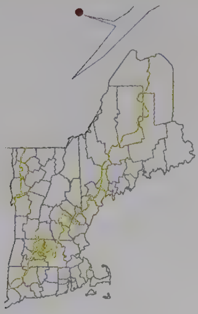


Distinguishing features:
A. Mandibles with 6 teeth (cf. *Temnothorax*)
B. Clypeus deeply notched (cf. other *Leptothorax* species)

Leptothorax sphagnicola Francoeur, 1986

The *Leptothorax* of the Moss

Refers to its habitat: *Sphagnum* (Lat: a genus of moss) + *-i(n)cola* (Lat: one who dwells in).

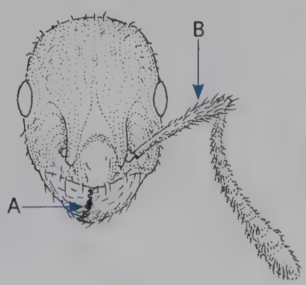


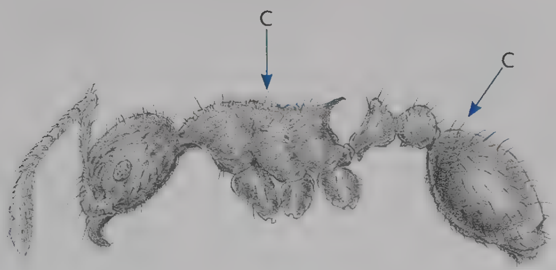
Habitat: Nests in *Sphagnum* and *Polytrichum* mosses in boreal spruce bogs.

Geographic range: Collected only from central Quebec in the Saguenay–Lac St. Jean region. Its specific habitat requirements suggest that it will be rare in New England, but the most likely places to find it are bogs in far northern Maine or atop New England's highest mountains. Note that if *Dolichoderus* species are present in a bog, it is probably too warm for *L. sphagnicola*.

Natural history: Makes small colonies (±35 workers) with multiple queens or at least ergatogynes, individuals that share characters of both workers and queens.

Look-alikes: Other *Leptothorax* species; of these, only *L. sphagnicola* has many erect hairs on its antennae and its rear tibiae.





Distinguishing features:

A. Mandibles with 6 teeth (cf. *Temnothorax*)

B. Antennal scapes with many erect hairs (cf. *L. muscorum* group)

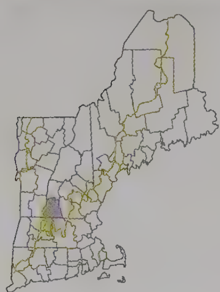
C. Erect hairs on mesonotum and gaster ~0.1 mm long

Leptothorax

Leptothorax wilsoni Heinze, 1989

Wilson's *Leptothorax*

Honors Harvard entomologist Professor E. O. Wilson (*b.* 1929).

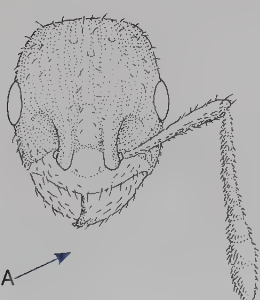


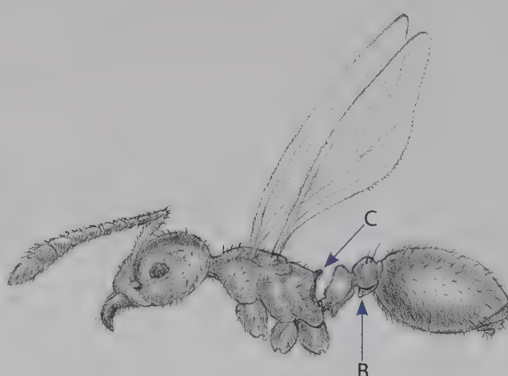
Habitat: Dead stems of open shrubs and small trees (1–3 m tall) growing in boreal forests and at high elevations. A workerless inquiline social parasite, *L. wilsoni* nests with its hosts, *L.* sp. AF-can or *L.* sp. AF-erg.

Geographic range: Alberta, Quebec, New Brunswick, Alaska, and its type locality, New Hampshire's Mount Monadnock, which the eponymous Harvard Professor E. O. Wilson referred to as "the back-yard of Harvard University."

Natural history: Kills the host queens before taking over the host colony. Like other inquiline social parasites, *L. wilsoni* relies on host workers to care for its queens and males.

Look-alikes: Other *Leptothorax* species; the single-toothed mandible and the lack of workers identify *L. wilsoni*.

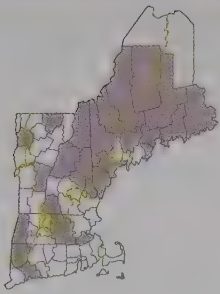




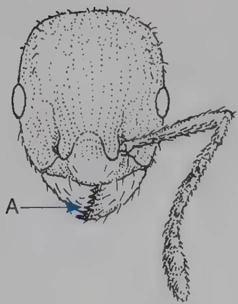
Distinguishing features:

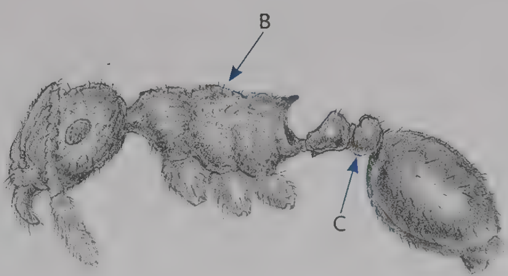
A. Mandibles with only 1 apical tooth (cf. other *Leptothorax* species)
B. Distinctive subpostpetiolar tooth (cf. *L.* sp. AF-can, *L.* sp. AF-erg)
C. Short and stubby propodeal spines

An undescribed species of *Leptothorax*, species code AF-can



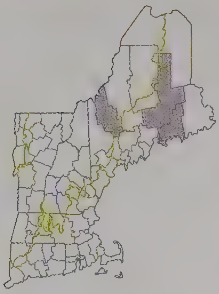
Habitat: Nests in stumps and rotten wood, under bark and rocks.
Geographic range: Throughout Canada and Alaska; New England; the upper Midwestern states; high elevations in the Rocky Mountains and southwestern states.
Natural history: Little is known of this species because for many years it was lumped together with others in the *Leptothorax muscorum* complex of species. It is one of two hosts for the social parasite *Leptothorax wilsoni*.
Look-alikes: *Leptothorax* sp. AF-erg; larger body size, shorter erect hairs on mesosoma, and no postpetiolar process identify *L.* sp. AF-can.



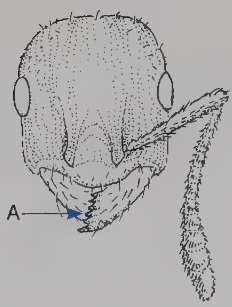


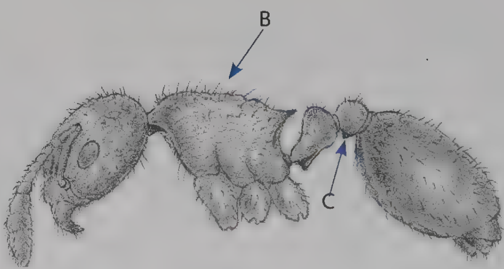
Distinguishing features:
A. Mandibles with 6 teeth (cf. *Temnothorax*)
B. Erect hairs on mesosoma < 0.04 mm (cf. *L.* sp. AF-erg)
C. No subpostpetiolar process (cf. *L. wilsoni*, *L.* sp. AF-erg)

Another undescribed species of *Leptothorax*, species code AF-erg



Habitat: Nests in stumps and rotten wood, under bark and rocks.
Geographic range: Throughout Canada; in New England, only in Maine. As more collections of *L.* "*muscorum*" are examined, a better sense of its range will emerge.
Natural history: Little is known of this species, because for many years it was lumped together with others in the *Leptothorax muscorum* species complex. It is one of two hosts for the social parasite *Leptothorax wilsoni*.
Look-alikes: *Leptothorax* sp. AF-can; smaller body size, longer erect hairs on mesosoma, and a postpetiolar process identify *L.* sp. AF-erg.





Distinguishing features:
A. Mandibles with 6 teeth (cf. *Temnothorax*)
B. Erect hairs on mesosoma > 0.07 mm (cf. *L.* sp. AF-can)
C. Pronounced subpostpetiolar process (cf. *L. wilsoni*, *L.* sp. AF-can)

Leptothorax

Monomorium Mayr, 1855

The One-Segmented Ants

From the Greek *monos*, meaning one,
+ *morion*, referring to a member or segment,
here, of the maxillary palp

Monomorium is a very diverse genus; nearly 600 species have been described, and approximately 400 species are currently recognized as valid. Fortunately for us, fewer than 20 species of *Monomorium* can be found in North America. Of these, only 4 are known from New England, 2—*M. pharaonis* and *M. floricola*—are tropical tramp species, and only 1, *Monomorium emarginatum*, is commonly collected in the field.

This genus is very easy to identify. *Monomorium* is nearly unique among New England Myrmicinae in that it lacks propodeal spines; our only other spineless Myrmicinae genus is *Solenopsis*. But our native *Monomorium* species have 12-segmented antennae with 3-segmented clubs and are dark green to jet black. In contrast, our *Solenopsis* species have 10-segmented antennae with 2-segmented clubs and are brownish yellow or lemon yellow in color. In describing the genus, Gustav Mayr named it for its one-segmented maxillary palp; he explicitly stated that the name is "in Beziehung auf die Kiefertaster" (in reference to the maxillary palp). Although the type species (*M. monomorium*) and our occasional *M. floricola* indeed have 1-segmented maxillary palps, our other New England *Monomorium* species have 2-segmented maxillary palps. In some Malagasy species, the maxillary palps may have 3 or even 5 segments.

Identifying the Species of *Monomorium*

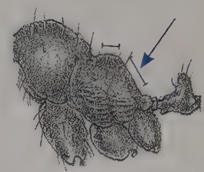
Only one species of *Monomorium*—*M. emarginatum*—is common throughout New England. It is dark black in color and is distinguished from *M. viride* by the greater length of the sloping posterior surface (the declivity) of its propodeum relative to the shorter dorsal surface. In *M. viride*, the dorsal surface is longer than the declivity. Furthermore, *M. viride* is a warm-climate species that is restricted to pure sand and has been collected so far only in the pine barrens of Massachusetts and southwestern Rhode Island. In contrast, *M. emarginatum* is much less particular about its nesting sites, although it also prefers sandy soils; it has been collected throughout New England, as far north as central Maine. The two other species are exotic, tropical species that survive only indoors in New England. The Pharaoh Ant, *M. pharaonis*, is easily identified by its overall yellow to light brown or red color and black-tipped gaster, whereas *M. floricola* is bicolored, with a dark head and gaster and a light brown mesosoma.

Key to the Species of *Monomorium*

1a. **These ants are concolorous**, dark green to black 2

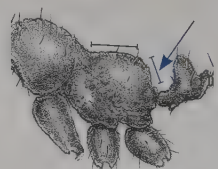
1b. **These ants are bicolored** or concolorous, but if they are concolorous, they are yellow to light brown and have a black-tipped or entirely black gaster 3

2a (1a). **The length of the dorsal surface of the propodeum is shorter than the length of the sloping posterior surface of the propodeum** (the declivity); the ant's body is black; it is widespread throughout New England .... *M. emarginatum*, p. 255



Relatively long declivity in *M. emarginatum*

2b. **The length of the dorsal surface of the propodeum is longer than the length of the declivity**; the ant's body is dark green to black; it nests only in pure, sandy soils ....*M. viride*, p. 258



Relatively short declivity in *M. viride*

3a (1b). **The ant is uniformly yellow-red or light brown** except for the gaster, which is dark brown or black at least at the tip, or throughout .... *M. pharaonis*, p. 257

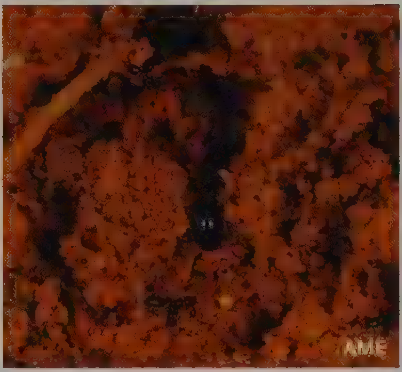
3b. **The ant is bicolored**, with a dark head and gaster and a light brown mesosoma......................... *M. floricola*, p. 256

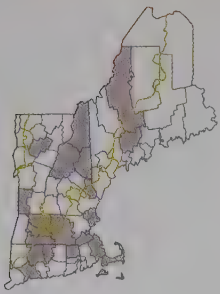
Monomorium

Monomorium emarginatum DuBois, 1986

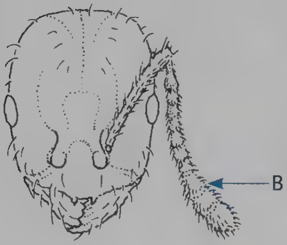
The Furrowed *Monomorium*

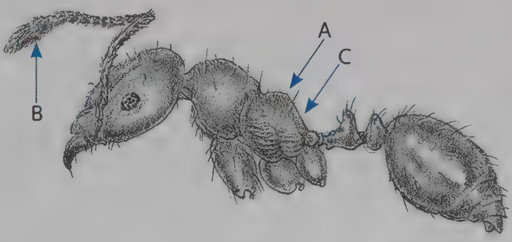
Refers to its furrowed (emarginate) mesonotum.





Habitat: Open areas in sandy or sandy-clayey soils.
Geographic range: Northeastern United States south to Virginia.
Natural history: Little is known of this species because it was identified as a unique species only 25 years ago. It makes small crater nests in open habitats. Colonies vary in size and are frequently polygynous. The omnivorous workers forage during the day and use scent trails to direct nestmates to good food supplies.
Look-alikes: *Monomorium viride, Solenopsis;* antennal segments and clubs distinguish the genera; dorsum-to-declivity ratio of the propodeum distinguishes the species.





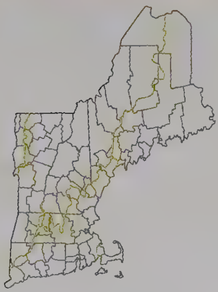
Distinguishing features:
A. Propodeum without spines
B. Antenna 12 segmented with 3-segmented club (cf. *Solenopsis*)
C. Length of propodeal posterior surface < declivity (cf. *M. viride*)

Monomorium

Monomorium floricola (Jerdon, 1851)

The Flower Ant

Refers to the flowers from which it was first collected: *floris* (Lat: flowers) + *-i(n)cola* (Lat: one who dwells in).

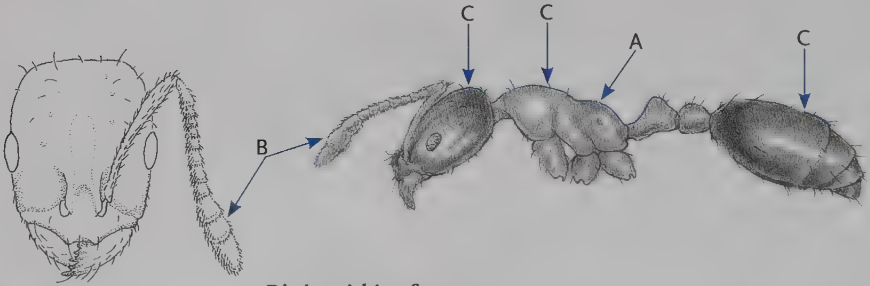


Habitat: Nests in hollow twigs and branches, under bark, and in dead plant stems in its native, tropical habitats. In New England, *Monomorium floricola* turns up hiding inside the hollow stems of sugarcane imported from tropical countries and sold in food markets, and it can survive only in heated structures.

Geographic range: Native to Asia; now worldwide in tropical regions.

Natural history: A tropical tramp. Queens of *M. floricola* are wingless; new colonies are formed by fission and fragmentation of larger colonies. The species' ability to make nests in very small spaces has undoubtedly helped it disperse widely.

Look-alikes: Unmistakable; we have no other similarly colored, tiny ant.



Distinguishing features:

A. Propodeum without spines

B. Antenna 12 segmented with 3-segmented club (cf. *Solenopsis*)

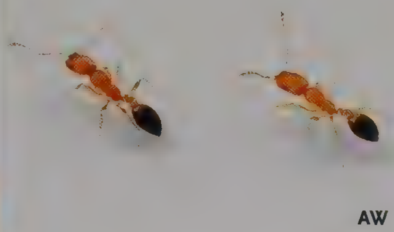
C. Bicolored (cf. *M. emarginatum, M. viride*); dark head and gaster, light mesosoma

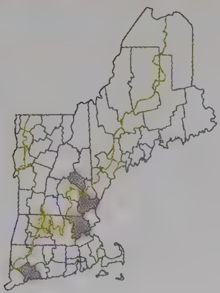
Monomorium

Monomorium pharaonis (Linnaeus, 1758)

*The Pharaoh Ant

Refers to Egypt, the land of the pharaohs, from which Linnaeus received the specimen that he described.





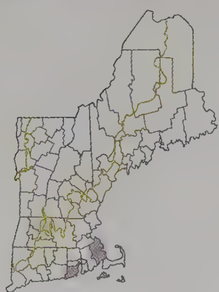
Habitat: Cracks, crevices, and inside buildings and tombs.
Geographic range: Native to Asia; worldwide in tropical regions. In New England, it nests only indoors; infestations reported from greenhouses in New Hampshire and buildings in New Haven, Connecticut, and the Harvard School of Public Health in Boston, Massachusetts.
Natural history: This tropical tramp forms large colonies (>10,000 workers). Queens of *M. pharaonis* are wingless; new colonies are formed by fission and fragmentation of larger colonies.
Look-alikes: *Solenopsis;* 12 antennal segments, a 3-segmented antennal club, and its unique coloration distinguish *M. pharaonis*.

Distinguishing features:
A. Propodeum without spines
B. Antenna 12 segmented with 3-segmented club (cf. *Solenopsis*)
C. At least tip of gaster dark brown or black

Monomorium viride Brown, 1943

The Green *Monomorium*

Refers to its color: *viridis* (Lat: green).



Habitat: Nests in open pine barrens, only in pure sand.
Geographic range: Eastern United States: Kingston, Rhode Island; Myles Standish State Forest and Cape Cod, Massachusetts; New Jersey Pine Barrens; coastal Georgia and Florida.
Natural history: Little is known of this species because it is geographically restricted in its distribution and has been confused with other *Monomorium* species. In the pine barrens of New Jersey and on Long Island, *M. viride* forms enormous polygynous colonies with large craterlike openings. Queens with *and* without wings are produced, but it is not known if there is any adaptive reason for producing these two types of queens.
Look-alikes: *Monomorium emarginatum, Solenopsis;* antennal segments and club distinguish the genera; propodeum dorsum-to-declivity ratio distinguishes the species. Queens of *M. viride* are more brown than green, and the queen's head and mesosoma are noticeably sculptured.

Distinguishing features:
A. Propodeum without spines
B. Antenna 12 segmented with 3-segmented club (cf. *Solenopsis*)
C. Length of propodeal posterior surface > declivity
(cf. *M. emarginatum*)

Monomorium

Myrmecina Curtis, 1829

The Little Ants

From the Greek *myrmex*, meaning ant, + *–ina*, a diminutive suffix

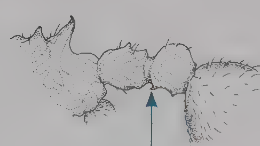
Myrmecina is a small genus of small ants; 37 species are recognized, only 3 of which occur in North America. Two of these species occur in New England, and they can be recognized by their barrel-shaped petiole and their propodeum, which is armed with two pairs of spines.

Identifying the Species of *Myrmecina*

The two species of *Myrmecina* can be distinguished by their color, the process underneath their postpetiole, and the degree of sculpturing on the body. The common *M. americana* is heavily sculptured and dark reddish-brown, and it has only a tiny toothlike process underneath its postpetiole. Our other undescribed species of *Myrmecina* is golden brown to reddish brown in color, has little sculpturing on its body, and has a large toothlike process underneath its postpetiole. This undescribed species is hypothesized to be a temporary social parasite or facultative slave-maker of *M. americana*, but not enough data are available yet to support or refute this hypothesis.

Key to the Species of *Myrmecina*

a. **The ant is reddish-brown or dark brown** with a heavily sculptured body and a tiny, toothlike process underneath the postpetiole .... *M. americana*, p. 261



Tiny process under the postpetiole of *M. americana*

b. **The ant is golden to reddish brown in color** and lightly sculptured, **with a pronounced toothlike process** underneath the postpetiole ....An undescribed species of *Myrmecina*, p. 262

Large process under the postpetiole of the undescribed *Myrmecina*

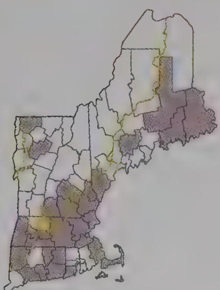
Easily Confused Species

The common *M. americana* can be confused on first glance with other small Myrmicinae such as *Leptothorax, Stenamma, Temnothorax,* or *Tetramorium*. But the barrel-shaped petiole and the two pairs of propodeal spines are unique to this genus.

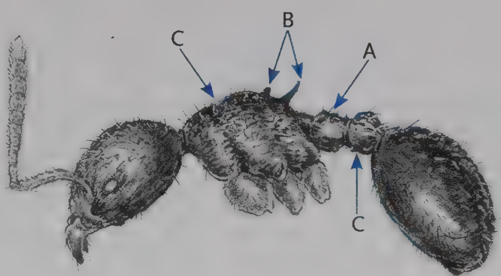
Myrmecina americana Emery, 1895

The American *Myrmecina*

Named for its close similarity to the European *Myrmecina graminicola.*



Habitat: Forests. This ant nests in soil, under rocks, in rotten nuts and acorns, in leaf litter, under logs.
Geographic range: North America except for the Rocky Mountains, California, and the Pacific Northwest.
Natural history: Colonies of *M. americana* are small (<100 ants) and usually monogynous. Seldom seen because workers rarely forage on the soil surface or in litter. Preys on other soil invertebrates, especially mites and springtails (Collembola).
Look-alikes: *Myrmica* species; two pairs of propodeal spines and the barrel-shaped petiole identify *Myrmecina.*

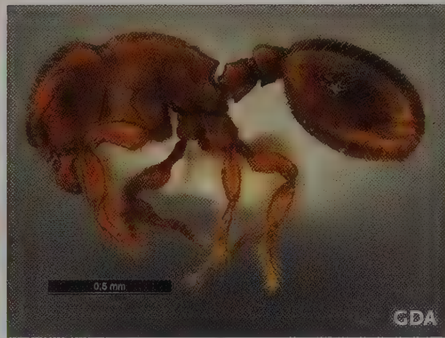


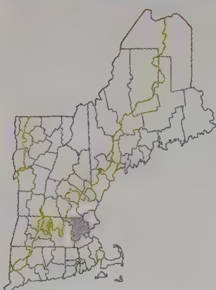
Distinguishing features:

A. Petiole cylindrical, barrel shaped in profile
B. Two pairs of propodeal spines (cf. *Myrmica* species)
C. Body heavily sculptured; no subpostpetiolar process (cf. unnamed *Myrmecina* species)

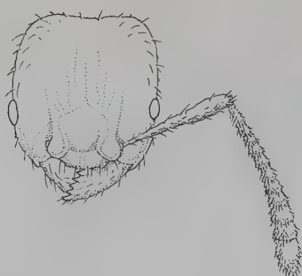
Myrmecina

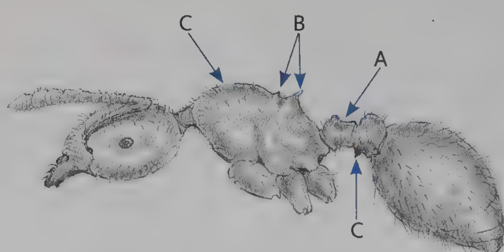
An undescribed species of *Myrmecina*





Habitat: Nests in mixed colonies with its host, *M. americana*.
Geographic range: Unknown; recorded from Massachusetts south to northern Florida; west to the Chiricahua Mountains in southeastern Arizona.
Natural history: A single queen produces numerous workers that forage for food and work in the colony. Observations suggest this new species of *Myrmecina* is a temporary social parasite or a facultative slave-maker of *M. americana*, but additional field observations and experimental data are needed to test this hypothesis.
Look-alikes: *Myrmecina americana, Myrmica lampra;* two pairs of propodeal spines and a barrel-shaped petiole separate the genera; color, body sculpturing, and presence or absence of a subpostpetiolar process distinguish the two *Myrmecina* species.





Distinguishing features:
A. Petiole cylindrical, barrel shaped in profile
B. Two pairs of propodeal spines (cf. *Myrmica* species)
C. Body lightly sculptured; large, toothlike subpostpetiolar process (cf. *Myrmecina americana*)

Myrmica Latreille, 1804

The Ants

From the Greek *myrmex*, meaning ant

Myrmica is a diverse genus of temperate zone ants, and it is one of the "big four" genera in New England—the other three are *Formica, Lasius,* and *Camponotus.* There are nearly 200 recognized species, but the exact number is not yet known; a 2010 analysis of the Palearctic ("Old World") species in the genus recognizes 142 extant and 5 fossil species of *Myrmica.* The Nearctic species are being assessed and taxonomically revised by Professor André Francoeur, but his revision has not yet been published. However, our presentation of the 21 New England species of *Myrmica* reflects extensive discussions we have had with Professor Francoeur, and we are fortunate to be able to include five as-yet-unnamed species in this field guide (we refer to these undescribed species using Professor Francoeur's standard abbreviations for them).

In North America, the distinguishing characteristic of the genus is the long tibial spur with its fine comblike teeth, but *Myrmica* can also be recognized by its size, color, generally heavy sculpturing, and, in all but two cases, long propodeal spines. One species in this group of medium-sized, reddish-brown ants, *M. rubra,* is known to the general public as the European Fire Ant and annoys picnickers on the beaches of Maine and Massachusetts. But there are at least 20 other species of *Myrmica* in New England—nearly half of the species currently known from this genus in North America. Three of the four *Myrmica* species that are social parasites on other *Myrmica* species are known from fewer than five records, and their ecological and behavioral characteristics are only beginning to be discovered. Careful study of this genus undoubtedly will yield new species and new insights into ant ecology.

Identifying the Two Categories and Nine Groups of *Myrmica* Species

The first step in differentiating among *Myrmica* species is to distinguish among two broad categories defined by the shape of the antennal scape near where it meets the head. The key characteristic—whether the bend at the base of the scape is smoothly rounded (curved) or sharply angled (angular) when viewed in profile—can sometimes be seen with a hand lens, but it is much clearer when viewed on pinned specimens at relatively low power (6–10×) under a dissecting microscope.

This character—the shape of the antennal bend—can be difficult to see because the position of the antenna will not be the same on every specimen or even on the two antennae of the same specimen (Figure 5.1). The reason that the position of the antenna will vary within and among specimens is that the antenna is connected to the head by a condyle, a ball joint similar to your hip. And, like your hip, each antenna rotates independently with respect to the head at its insertion (see Figure 5.1).

It is very difficult to see the antennal bend if the specimen is not pinned, so start by pinning your *Myrmica*. Now, move the specimen around until you can clearly see the profile of the antenna. Sometimes you will see it when the ant is in full-face view, and sometimes you may have to tip the ant backward and look at its face from below (see Figure 5.1). Once you can see the profile, decide whether the antennal bend is smoothly rounded and curved (Figure 5.2) or sharply angled (Figure 5.3). In the description of each *Myrmica* species, we note whether the characters of the antenna should be observed in profile view (Figure 5.1, top) or in dorsal view (Figure 5.1, bottom), where "profile" and "dorsal" views are designated with respect to the antennal scape.

Now that you've decided on the shape of the antennal bend, move on to the species groups: we recognize four groups in the "antennal bend curved" and five groups in the "antennal bend angular" categories. In both antennal bend categories, these groups are distinguished by the shape of the clypeus and the frontal lobes on the head, the degree and shape of sculpturing on the head and mesosoma, and whether there are coarse punctures at the

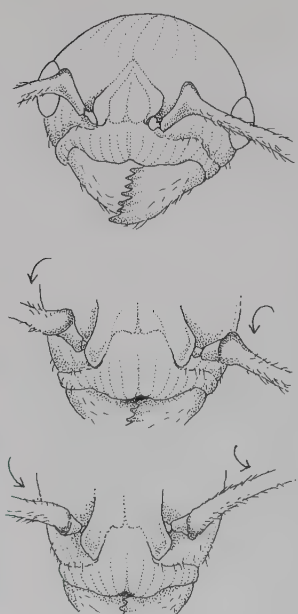


Figure 5.1. To accurately determine the shape of the antennal bend, you must first orient the pinned specimen so that you can view the scape in profile view (top). Because each scape can move independently and rotates on its condyle with respect to the head (middle), you may find that you need to reorient the specimen away from the accustomed "full-face view" to see the shape of the antennae in profile and to clearly see any flanges, laminae, or lamellae that are best seen in dorsal view (bottom). Drawings by Elizabeth Farnsworth.

Myrmica

Figure 5.2. The shape of the antennal scape where it inserts into the head is curved in some of the New England *Myrmica* species. Note that the head has been rotated posteriorly in this drawing to clearly show the profile of the antenna. Drawing by Elizabeth Farnsworth.

Figure 5.3. Viewed in profile, the shape of the antennal scape where it inserts into the head is sharply angled in other New England *Myrmica* species. Note that the head has been rotated posteriorly in this drawing to clearly show the profile of the antenna. Drawing by Elizabeth Farnsworth.

base of the hairs on the gaster. Unlike in the genus *Formica,* in which identifying species groups is easy and identifying species within groups is hard, in *Myrmica* it turns out that it is more difficult to distinguish among species groups than to distinguish species within each group. So to learn *Myrmica,* take your time learning the groups.

The four species groups in the antennal bend curved category are the *rubra, incompleta, punctiventris,* and *lobifrons* groups. The *rubra* group—a Palearctic group represented in New England only by *M. rubra*—has small, thin frontal lobes that point upward so that the bases of the antennae are clearly visible. The edges of the frontal lobes are evenly convex, and the triangle between the two frontal lobes is smooth, often shiny, and lacks the prominent ridges (rugae) that are visible on the rest of the head and mesosoma.

The three species in the *punctiventris* group have a large, coarse pit or puncture at the base of each erect hair on their gasters. Unique among all of our *Myrmica* species groups, ants in the *punctiventris* group have a propodeum that is noticeably lower than the promesonotum, giving the mesosoma a stepped-down appearance. Also, the edges of their frontal lobes are rounded or somewhat convex, and the margin of the clypeus is more or less angular.

The four species in the *incompleta* group have a smoothly convex or modestly concave clypeal margin; only small, generally inconspicuous pits at the base of the hairs on their gasters; and frontal lobes that are triangular or rounded. The propodeum of ants in the *incompleta* group is at the same

level as the pronotum, as it is in all other New England *Myrmica* species. Finally, the two species in the *lobifrons* group have a shallow to deeply notched clypeus.

The antennal bend angular category is broken up into five species groups: *sculptilis, latifrons, nearctica, detritinodis,* and *scabrinodis.* The *scabrinodis* group—another Palearctic group—is represented in New England only by *M. scabrinodis.* It has a prominently flattened scape that gives it a tapered (not round) appearance in cross section (to use this character, imagine cutting the scape like a salami and looking at the shape of the slice). As of this writing, *M. scabrinodis* has been found only on three islands in Boston Harbor and in a single backyard in Porter Square in Cambridge, Massachusetts. This last specimen was found only three months before this guide went to press!

The *sculptilis* group, which consists of two as-yet-undescribed species, is characterized by thick, rounded, parallel rugae (ridges) on the head, mesosoma, petiole, and postpetiole and by extended wings on the side of the clypeus that create a ridge that encloses the antennal socket. The sculpturing at the bend of the antennal scape is relatively inconspicuous on top but more pronounced along the inner descending side. The remaining groups have thinner rugae on their heads, mesosomas, petioles, and postpetioles, and their rugae are wavy and netlike (anastomosing).

The three species in the *nearctica* group each have a clypeus that is convex, a flat lower surface of their postpetiole, and antennal scapes that are uniformly wide over their entire length. The projection at the bend of the antennal scape looks like a soup spoon.

The one New England species in the *latifrons* group—*M. latifrons*—has characters that are intermediate between the *sculptilis* and *nearctica* groups. It has only a shallow concavity (barely a notch) on the margin of its clypeus and a lobed lower surface on its postpetiole.

Finally, the four species in the *detritinodis* group have antennal scapes that are not uniformly wide over their entire length. Rather, their scapes taper and are narrower at the base (closer to the head). The projection at the bend of the antennal scape is less conspicuous on top but more conspicuous along the inner side of the base, facing the head. One of the species in the *detritinodis* group has no propodeal spines and is thought to be a workerless social parasite. It is known from only a single specimen collected in 2006 in a pitfall trap in a blueberry barren in Maine; it is not yet formally named.

Identifying the Species of *Myrmica*

Once you've gotten this far, you've accomplished the hardest part of identifying *Myrmica* species: figuring out to which group it belongs. Three of the groups—*rubra, scabrinodis,* and *latifrons*—have only one species apiece

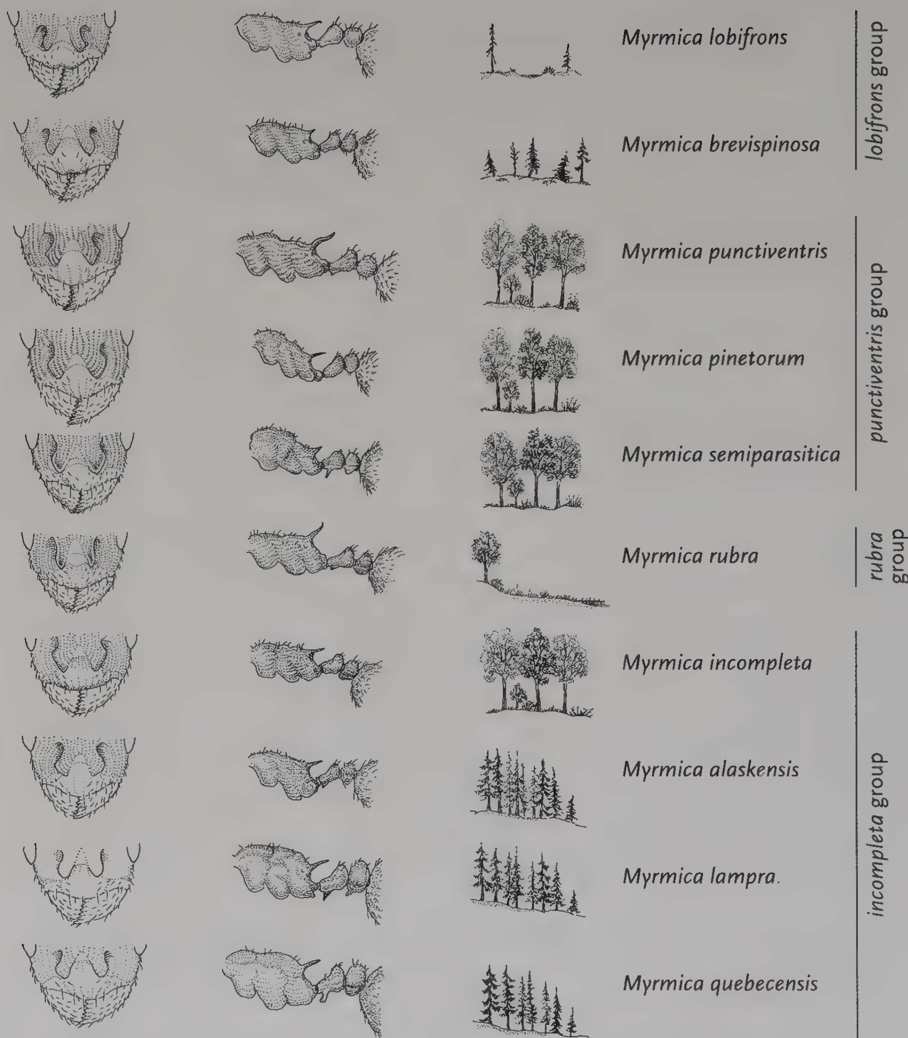
in New England, so identifying the species group is the same as identifying the species. Otherwise, once the species group has been identified, we look to the clypeus, propodeal spines, and habitat to distinguish among species within groups of the antennal bend curved category. We also use sizes and shapes of the processes, lobes, and flanges decorating the antennal bend itself to distinguish species within groups of the antennal bend angular category. The variation in shape, form, and sculptured processes visible on the scape is best seen on pinned specimens viewed at 25–50× under a dissecting microscope.

Once again, we start with the groups in the antennal bend curved category. Many of these species are habitat specialists, which can often help you make a reliable species determination if you got the species group right.

The *incompleta* group—If you are in a deciduous forest, you most likely have *M. incompleta,* which also has a bulging clypeus with a straight to concave anterior margin and netlike rugae on the top of its head. If you are in a boreal forest in Maine or near the tree line in the mountains of Vermont or New Hampshire, you most likely have *M. alaskensis,* which has a convex margin on its flattened clypeus and very parallel rugae on the top of its head. The other two species in this group are inquiline social parasites of *M. alaskensis* that produce only queens and males and are distinguished by the size and shape of the process protruding from the bottom of their petiole. The process below the petiole of *M. quebecensis* is long and rectangular, whereas the process below the petiole of *M. lampra* is conically shaped. Neither of these parasitic species has much sculpturing, but of the two, *M. lampra* has virtually none at all, whereas *M. quebecensis* has light sculpturing. To date, *M. alaskensis* has been collected only in Maine, but neither *M. lampra* nor *M. quebecensis* has yet been collected in New England.

The *lobifrons* group—The two species in the *lobifrons* group are best distinguished by habitat, clypeus, and propodeal spines. *Myrmica lobifrons* is a bog specialist with a deeply notched clypeus and long propodeal spines that curve downward at their tips. *Myrmica brevispinosa* is a boreal species known in New England up to now only from the White Mountains of New Hampshire and Down East Maine. It has a shallowly notched clypeus and short spines that point straight upward.

The *punctiventris* group—The three species in this group are distinguished by characteristics of their propodeal spines. *Myrmica punctiventris* has long, wavy spines that are reminiscent of the curving horns of a long-horned steer. The spines are much longer than the distance separating their tips. In contrast, *M. pinetorum* has shorter spines that point straight upward at an angle of approximately 45°, and these spines are only as long as, but usually shorter than, the distance separating their tips. Finally, *M. semiparasitica* is a temporary social parasite of *M. punctiventris.* It has very short propodeal spines with large, thick bases and small teeth along their



lower surfaces. This species also has a pronounced triangular process below its petiole. It has been collected only at two locations in New England: on Nantucket Island and in the Waterboro Pine Barrens in southern Maine.

The matrix key above illustrates five morphological characters and one habitat character that can be used to separate *Myrmica* species in the antennal bend curved group. Color and size are of little help here; all of our New England *Myrmica* species are varying shades of brown and 3–5 mm long. Instead, look first at the clypeus. *Myrmica lobifrons* and *M. brevispinosa* have pronounced clypeal notches. These two species can then be distinguished by the lengths of their propodeal spines (long in *M. lobifrons,* short in the aptly named *M. brevispinosa*) and their habitat (bogs for *M. lobifrons,*

boreal woodlands for *M. brevispinosa*). Next, look at the relative levels of the pronotum and the propodeum. The propodeum in ants of the *M. punctiventris* group are noticeably lower than the pronotum, giving the back a stepped-down appearance. In this group, the propodeal spines of *M. punctiventris* are long—longer than the distance between their tips—and wavy like the horns of a long-horned steer. In contrast, the propodeal spines of *M. pinetorum* are shorter than the distance between their tips and straight. Finally, the spines of *M. semiparasitica* are short, and this species, a temporary social parasite of *M. punctiventris*, has a large triangular process underneath its petiole. Return to the face. If the frontal lobes are thin, small, and pointing straight up, you probably have the European Fire Ant, *M. rubra*. Otherwise, you are in the *M. incompleta* group, which has thick triangular or rounded frontal lobes that are oriented more horizontally. The four species in this group are easy to tell apart. *Myrmica incompleta* is a temperate species of deciduous forests. Its clypeus bulges out below its triangular frontal lobes. *Myrmica alaskensis* is a cold-climate species of boreal forests. It, too, has triangular frontal lobes, but its clypeus does not bulge out. The other two species are inquiline social parasites of *M. alaskensis* that rely on the host workers for food, shelter, and rearing of the parasite queens and males, so the parasite will be collected only in association with the host. Both parasitic species have pronounced processes underneath their petioles; the process of *M. lampra* is conical, whereas the process of *M. quebecensis* is rectangular.

Turning to species in the antennal bend angular category, we look first at the antennal scapes and then at the shape of the lateral wings of the clypeus. Remember to pin your specimen and reorient it so that you can see the scape in profile (face on) or in dorsal view (from the top down), depending on the character you need (see Figure 5.1). Look at the clypeus and its lateral wings in full-face view. Unlike species in the antennal bend curved category, there are few habitat specialists in the species with angular antennal bends. However, there are enough differences among species in their nesting habitats that you can often eliminate some species from consideration based on where you collected them.

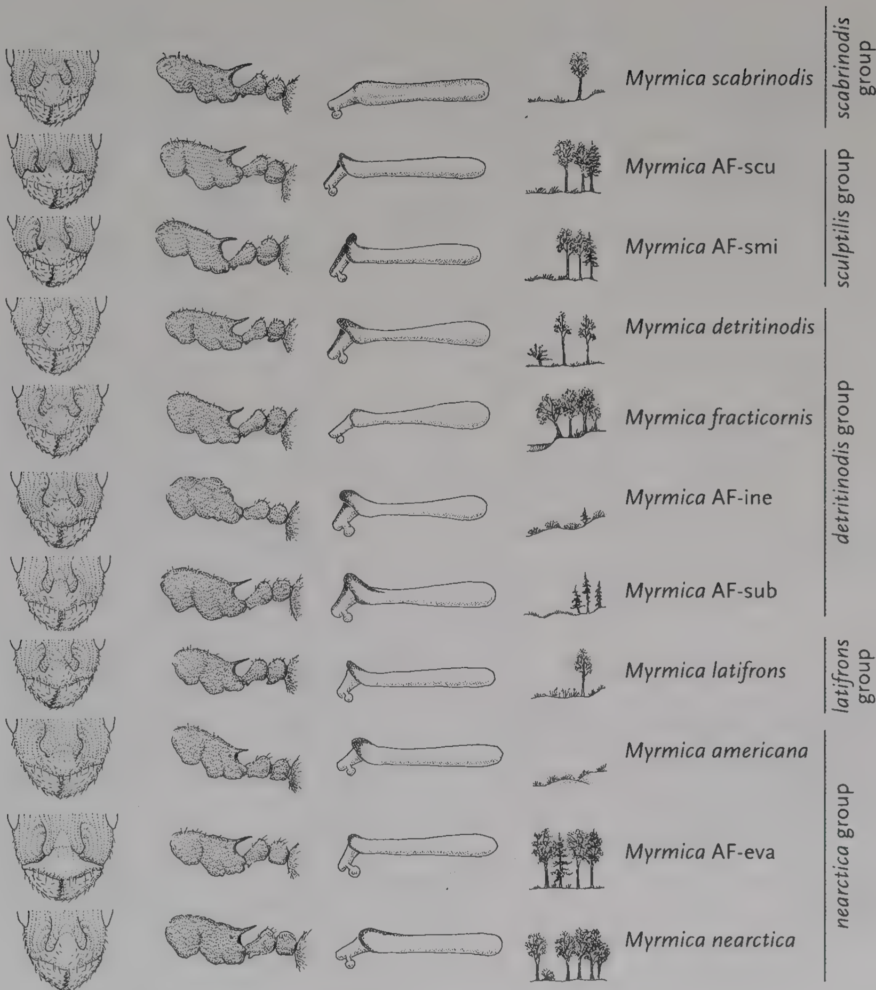
The *detritinodis* group—The four species in the *detritinodis* group have an antennal scape that, in dorsal view, is narrower toward its base (near the bend) than it is at its end. Continue looking at the scape from the top down (in dorsal view), and rotate it slowly toward you (anteriorly). The thin tissue (lamina) at the base of the scape is small and barely visible in *M. fracticornis*, larger and running down the inside of the base of the scape in *M. detritinodis* and *M.* sp. AF-ine, and very large but with less of a lamina running down the inside of the scape in *M.* sp. AF-sub. All four of the *detritinodis*-group species are cold-climate specialists. *Myrmica* sp. AF-sub is known

from the southern shores of Hudson Bay and has been collected at the airport at Goose Bay, Labrador, and at Peggy's Cove near Halifax, Nova Scotia. Only the spineless queen of *M.* sp. AF-ine has been collected, and only one specimen at that, from a blueberry barren in Maine. It is much more likely that you will collect *M. detritinodis,* which is common in northern woodlands, or *M. fracticornis,* which is common along forest edges, on shrubby shores along rivers, and in other disturbed but wooded areas of New England.

The *nearctica* group—The three species in the *nearctica* group have an antennal scape that, seen in dorsal view, is equally wide along its entire length and have a pronounced platelike structure (lamella) atop the bend of the antennal scape. In *M. americana* this lamella is circular and spoonlike and projects upward. Its shape is similar to that of the soup spoons gracing the tables of Chinese restaurants. In *M.* sp. AF-eva the lamella is smaller but still circular and spoonlike and barely projects above the antennal scape; confirm this by rotating the specimen and observing the antenna and its lamella in profile view. In *M. nearctica* the lamella is large and circular, but in dorsal view the lamina extends along the inner side of the scape outward toward the end of the scape and away from the head.

The *sculptilis* group—Finally, the two undescribed species in the *sculptilis* group are distinguished by the lamella on the bend of the scape. Start by looking at this lamella in dorsal view, then rotate the specimen toward you (anteriorly) so you can see the inside of the antennal bend. In *M.* sp. AF-scu this lamella is small (in dorsal view) and does not extend beyond the base of the scape (rotate the specimen anteriorly from dorsal view); the frontal lobes of *M.* sp. AF-scu, viewed in full-face view, are flattened and cover the base of the antennae. In contrast, the lamella of *M.* sp. AF-smi is large (in dorsal view) and extends beyond the base of the scape (in anteriorly rotated view). In full-face view, the frontal lobes of *M.* sp. AF-smi point upward, exposing the base of the antennae. The frontal lobes also often have two separate ridges along their edges, whereas there is only one ridge along the edge of each frontal lobe of *M.* sp. AF-scu.

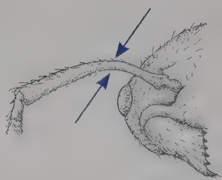
The matrix key on p. 271 illustrates six morphological characters and one habitat character that can be used to separate *Myrmica* species in the antennal bend angular group. As with the other group of *Myrmica* species, color and size are of little help here; these are all medium-sized, brownish ants. Rather, the key characters are the antennal scapes (here drawn in three-quarters view, a compromise between profile view and dorsal view, and with the base and condyle extended to reveal the inside of the base); the frontal lobes; and the clypeus, as well as the body sculpturing and the propodeal spines. Start with the antenna. The European species *M. scabrinodis* has a horizontal ridge running along the top of its antennal scape, which is also triangular in cross section. Next, look at the thick ridges (rugae) that run along the sides and top of the body. Ants in the *M. sculptilis* group have thick, parallel rugae that are rounded in cross section. The two undescribed



species in this group are distinguished by the lamina at the bend of the scape —small in *M.* sp. AF-scu, large in *M.* sp. AF-smi—and by whether the frontal lobes cover the antennal insertion (*M.* sp. AF-scu) or not (*M.* sp. AF-smi). The antennal scape tapers toward its base (toward the head) in the *detritinodis* group but is untapered in the *latifrons* and *nearctica* groups. In the *detritinodis* group the species are distinguished by the size of the lamina at the antennal bend (small in *M. fracticornis,* large in *M.* sp. AF-sub, and intermediate in *M. detritinodis* and *M.* sp. AF-ine), the presence or absence of propodeal spines (absent in *M.* sp. AF-ine), and habitat (*M. detritinodis* in northern forests and open woodlands; *M. fracticornis* in moist forests and wet meadows and at streamsides and riversides; *M.* sp. AF-sub in boreal forest and tundra; and *M.* sp. AF-ine in areas about which we are uncertain because it has so far been collected only in a blueberry barren). The *latifrons* and *nearctica* groups are distinguished by the shape of the lower surface of

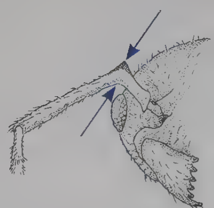
the postpetiole: it is rounded and lobed in the *latifrons* group and flat in the *nearctica* group. Our only species in the *latifrons* group is *M. latifrons*. In the *nearctica* group, *M. americana* is a common species of open fields, grasslands, and sandy areas. It has a distinctive spoon-shaped lamina on top of the antennal bend. *Myrmica* sp. AF-eva has a much smaller lamina on top of the antennal bend that only hints at being a spoon. It is a recent arrival in eastern North America and so far is known only from disturbed areas; in its home range in central North America it is a grassland specialist. The antennal lamina on the heavily sculptured *M. nearctica* extends anteriorly along the inner margin of the scape.

Key to the Species of *Myrmica*



The antenna, viewed in profile, curves at its base.

1a. **Antennal scape** viewed in full profile **evenly curved near its base**.. 2



The antenna, viewed in profile, makes a right-angled bend at its base.

1b. **Antennal scape** viewed in full profile **bent abruptly near its base** at a nearly 90° (right) angle; there is often a thick lamina or other outgrowth on the dorsal surface of the bend 11

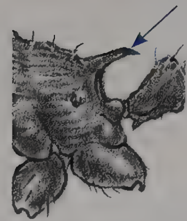
Notched clypeus of the *lobifrons* group

2a (1a). **Anterior margin of clypeus distinctly notched;** if the notch is shallow, the propodeal spines are short.. (*lobifrons* group) 3

2b. **Anterior margin of clypeus usually without a notch**; if a very shallow notch is present, the clypeus bulges outward in the middle and the propodeal spines are long.. 4

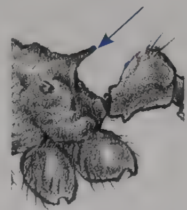
Myrmica

3a (2a). Clypeus deeply and distinctly notched; **propodeal spines long** and pointed rearward at an ˜45° angle and with tips that curve gently downward; **this ant is a bog specialist**.. *M. lobifrons*, p. 288



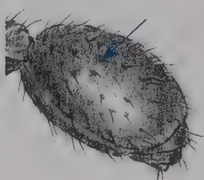
Long propodeal spines of *M. lobifrons*

3b. Clypeus shallowly notched; **propodeal spines short and pointing straight upward**; this is a boreal species known in New England only from the White Mountains of New Hampshire and Down East Maine ....*M. brevispinosa*, p. 282



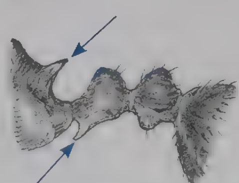
Short propodeal spines of *M. brevispinosa*

4a (2b). **Coarse, large punctures** (pits) at the base of the erect hairs on the top of the gaster; the level of the propodeum is noticeably lower than the level of the promesonotum.......................... (*punctiventris* group) 5



Pronounced punctures at the base of the erect hairs on the gaster of the *punctiventris* group

4b. No, or at best fine, **inconspicuous punctures** at the base of the erect hairs on the top of the gaster; the level of the propodeum is more or less even with the level of the promesonotum....................................7



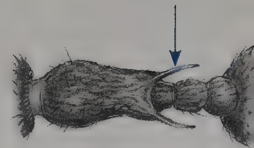
Short propodeal spines and large subpetiolar process of *M. semiparasitica*

5a (4a). **Propodeal spines short with a thickened base; a large triangular process is visible below the petiole**; this ant is a temporary social parasite of *M. punctiventris*........................ *M. semiparasitica*, p. 295

5b. **Propodeal spines long, with a narrow base; a triangular process below the petiole is absent or inconspicuous** 6

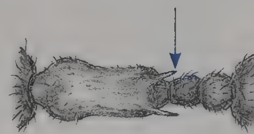
Myrmica

6a (5b). **Propodeal spines longer than the distance separating their tips** and often wavy; frontal lobes extend upward at a shallow angle, exposing the insertion of the antennae; rugae thick but flattened on top .... *M. punctiventris*, p. 291



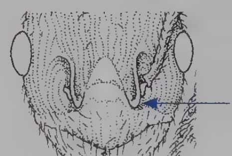
Long, curved, close-set propodeal spines of *M. punctiventris*

6b. **Propodeal spines shorter than the distance separating their tips** and usually straight; frontal lobes flat to the head, often with a distinct downward deflection at their edges, and covering the insertion of the antennae; rugae thick and rounded on top .... *M. pinetorum*, p. 290



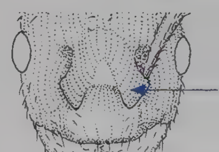
Short, straight, widely separated propodeal spines of *M. pinetorum*

7a (4b). Viewed from above, **frontal lobes thin and pointed upward,** exposing the insertion of the antennae; clypeal margin with small indentations; this is an introduced Palearctic species common along coasts and rivers, as well as in disturbed or urban areas....................................... *M. rubra*, p. 293



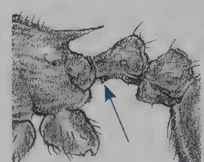
Thin frontal lobes of *M. rubra*

7b. Viewed from above, **frontal lobes thick and laterally extended,** at least partially covering the insertion of the antennae; clypeal margin entire, without small indentations.. (*incompleta* group) 8



Thick frontal lobes of the *incompleta* group

8a (7b). **The head, clypeus, mesosoma, and petiole of these ants are heavily sculptured and striated; lower surface of petiole with at most a small outgrowth or process;** top of postpetiole in side view evenly (straight) sloped.............................. 9



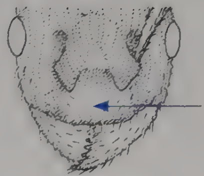
Small process under the petiole of *M. incompleta* and *M. alaskensis*

8b. **These ants are weakly sculptured, if at all; lower surface of petiole with a large process;** top of postpetiole hump shaped in profile;

Myrmica

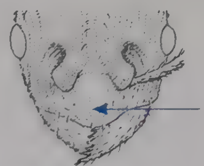
these ants are inquiline social parasites; if workers are present, they lack the process under the petiole and instead are workers of the host species 10

9a (8a). **An ant of deciduous forests; the clypeus bulges in the middle and is straight or modestly concave on the margin;** rugae on top of the head anastomosing and netlike .... *M. incompleta*, p. 285



Bulging clypeus of *M. incompleta*

9b. **An ant of boreal forests; clypeus evenly convex in the middle and distinctly convex on the margin;** rugae on top of the head parallel.......................... *M. alaskensis*, p. 280



Flattened clypeus of *M. alaskensis*

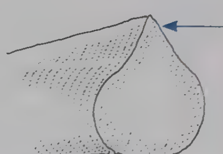
10a (8b). **Process below the petiole conical and angular;** the ant is shiny, with virtually no sculpturing; it is an inquiline social parasite of *M. alaskensis*.............................. .... *M. lampra*, p. 286

Conical subpetiolar process of *M. lampra*

10b. **Process below the petiole large, rectangular, and blunt;** the ant is not very shiny, with light sculpturing; it is an inquiline social parasite of *M. alaskensis*..................... ....*M. quebecensis*, p. 292

Rectangular subpetiolar process of *M. quebecensis*

11a (1b). **Antennal scape tapered on both sides, giving it a ridge on top and a triangular appearance in cross section;** this ant is a Palearctic, non-native species........... .... *M. scabrinodis*, p. 294



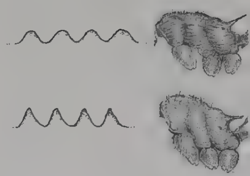
Triangular cross section of antenna of *M. scabrinodis*

Myrmica

11b. **Antennal scape not tapered, giving it a rounded shape in cross section**; these ants are Nearctic, native species... 12

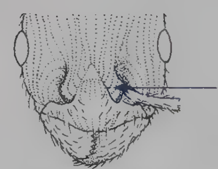
12a (11b). **Mesosoma, petiole, and postpetiole with thick, parallel rugae that appear round in cross section**; in full-face view, lateral wings of clypeus extended and raised anteriorly into a ridge that encloses the antennal socket; in dorsal view, the lamella on the antennal bend is most apparent on the interior side, not on top, of the bend ....(*sculptilis* group) 13

12b. **Mesosoma, petiole, and postpetiole with thinner, netlike, anastomosing rugae that appear sharply angled in cross section**; in full-face view, lateral wings of the clypeus usually not raised anteriorly into a ridge that encloses the antennal socket; if the clypeal wings are raised and enclose the antennal socket, the lamella on the top of the antennal bend, in dorsal view, is apparent and well developed........14



Cross sections (left) and profile views (right) of the rugae of the *sculptilis* group (top) and other *Myrmica* groups (bottom)

13a (12a). **In full-face view, frontal lobes large and rounded, covering the antennal socket**; in dorsal view, antennal scape has a small outgrowth or lamella that is not wider than the base itself; the scape also has a ridge running along the inside of its base (toward the head)................................... ....*Myrmica* sp. AF-scu, p. 298

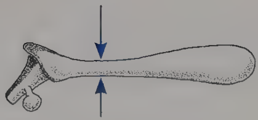


Frontal lobes cover the antennal insertion of *Myrmica* sp. AF-scu.

13b. **Frontal lobes smaller and with a convex margin, not covering the antennal socket**; margin of the frontal lobes may have two separate ridges; in dorsal view, the lamella on the base of the scape is wider than the base itself................................... ....*Myrmica* sp. AF-smi, p. 299

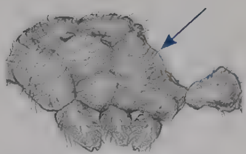
Myrmica

14a (12b). **In dorsal view, the shaft of the antennal scape is distinctly narrower at the bend than it is at its apex**; the lamina on the dorsal part of the antennal bend may extend downward toward the head but never extends along the scape itself........................ (*detritinodis* group) 15



In dorsal view, the antennal shaft tapers in the *detritinodis* group.

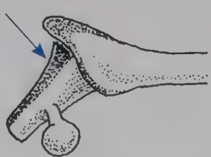
14b. **In dorsal view, the shaft of the antennal scape is more or less uniformly wide across its entire length**; the lamina on the dorsal part of the scape does not extend downward toward the head but may extend anteriorly along the scape itself...18



Absence of propodeal spines on *Myrmica* sp. AF-ine

15a (14a). **Propodeum without spines**; rugae create a spider-web pattern on the head, with anastomosing rugae on the sides ....*Myrmica* sp. AF-ine, p. 297

15b. **Propodeum with spines** 16

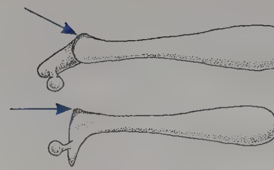


In dorsal view, the lamina continues down the inside of the base of the antenna of *M. detritinodis*.

16a (15b). **In dorsal view, the bend of the antennal scape has a curved or transverse lamina that continues downward along the inner side of the base** (toward the head); this is a species of forested habitats .... *M. detritinodis*, p. 283

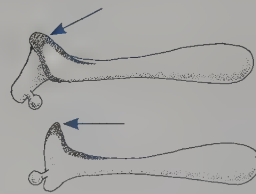
16b. **In dorsal view, the lamina at the bend of the antennal scape is restricted to the top of the scape** and does not run downward along the base of the antenna; this is a species of open and forest-edge habitats 17

17a (16b). **In dorsal view, the lamina at the bend of the scape is small and barely visible;** this is a widespread ant of open habitats in northern New England .... *M. fracticornis*, p. 284



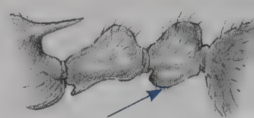
In dorsal view, the lamina on the antenna of *M. fracticornis* is small and inconspicuous.

17b. **In dorsal view, the lamina at the bend of the scape is large and conspicuous;** this is an uncommon, boreal species ....
...............*Myrmica* sp. AF-sub, p. 300



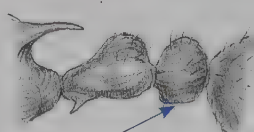
In dorsal view, the lamina on the antenna of *Myrmica* sp. AF-sub is large and conspicuous.

18a (14b). **The lower surface of the postpetiole is lobed and projects forward** when viewed in profile .... *M. latifrons*, p. 287



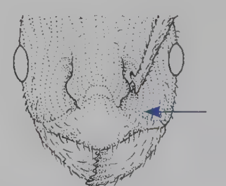
The lower surface of the postpetiole is lobed and projects forward in *M. latifrons*.

18b. **The lower surface of the postpetiole is flat;** in profile, the postpetiole does not project forward........................ (*nearctica* group) 19



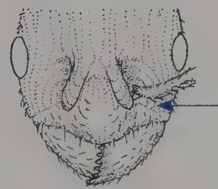
The lower surface of postpetiole is flat in the *nearctica* group.

19a (18b). **In full-face view, the lateral wings of the clypeus are raised into a ridge that closes the antennal socket;** the margins of the frontal lobes are evenly rounded over most of their length; in dorsal view, the lamella at the antennal bend is spoon shaped, not extending along the inner side of the scape toward its apex ....
.... 20



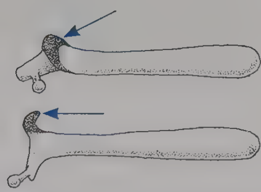
The clypeus closes the antennal socket of *M. americana*.

19b. **In full-face view, the lateral wings of the clypeus are flattened and do not close the antennal socket;** the margins of the frontal lobes are rounded toward the front but straight or convex posteriorly; in dorsal view, the lamella at the antennal bend is large, and the lamina extends along the inner margin of the scape anteriorly toward its apex.............. .... *M. nearctica*, p. 289



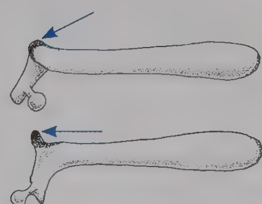
The clypeus does not close the antennal socket of *M. nearctica*.

20a (19a). **In dorsal view, the bend of the antennal scape has a large, circular, spoonlike lamella** that projects sharply upward .... *M. americana*, p. 281



In dorsal view, the antennal lamella of *M. americana* is large and spoonlike.

20b. **In dorsal view, the bend of the antennal scape has a smaller lamella that is barely deflected inwardly,** giving it a shallow spoon shape......... ....*Myrmica* sp. AF-eva, p. 296



In dorsal view, the antennal lamella of *Myrmica* sp. AF-eva is shaped like a small, shallow spoon.

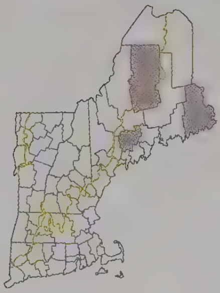
Easily Confused Species

In the field, *Myrmica* may be mistaken for *Aphaenogaster. Myrmica* species are relatively slow moving and make small colonies, whereas *Aphaenogaster* move rapidly and can have very large colonies. The profiles of the mesosomas of these two genera differ dramatically and can be distinguished with a 5× or 10× hand lens. The mesonotum is close to the same level as the pronotum in *Myrmica*, but the mesonotum is much lower than the pronotum in *Aphaenogaster*. The body of *Myrmica* species is usually heavily sculptured with rugae, whereas the body of *Aphaenogaster* species is comparatively lightly sculptured. *Myrmica* and *Myrmecina* may also be confused in the field, but *Myrmica* has one pair of propodeal spines and a triangular petiole, whereas *Myrmecina* has two pairs of propodeal spines and a cylindrical, barrel-shaped petiole.

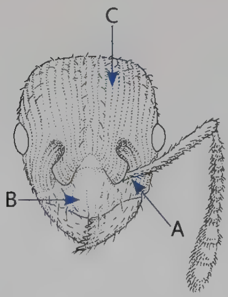
Myrmica alaskensis Wheeler, 1917

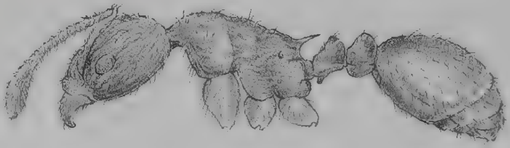
The Alaskan Ant

Named for its type locality, Seward, Alaska.



Habitat: Boreal forests; nests in soil.
Geographic range: Throughout Canada and Alaska; in the lower United States: Maine, Michigan, and at high elevations in the Rocky Mountains.
Natural history: Digs tunnels around plant roots to find and tend root-feeding aphids for honeydew.
Look-alikes: *Myrmica incompleta;* a convex clypeal margin, flattened (not bulging) clypeus, and parallel rugae on the head identify *M. alaskensis.*



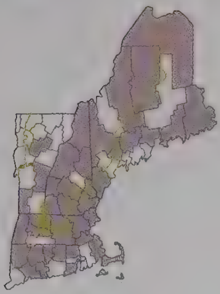


Distinguishing features:
A. Scape gently curved to insertion
B. Clypeus flattened; clypeal margin convex (cf. *M. incompleta*)
C. Rugae atop head parallel

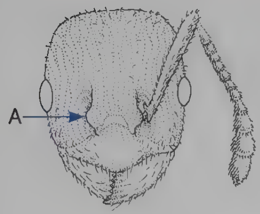
Myrmica americana Weber, 1939

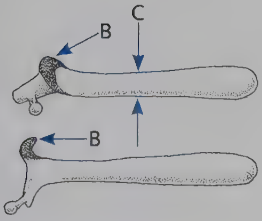
The American Ant

Named for its widespread distribution in North America.



Habitat: Sandy soil of open fields and grasslands.
Geographic range: Throughout eastern North America from the Canadian Maritime Provinces and Quebec south to North Carolina; west to Manitoba in the north and Arizona in the south.
Natural history: An omnivorous species that feeds on plant secretions; honeydew from tended scale insects, aphids, and lacewings; animal carcasses.
Look-alikes: *Myrmica nearctica*–group species; the distinctive spoon-shaped lamella atop the bend of its antennal scape and evenly rounded frontal lobes distinguish *M. americana*.





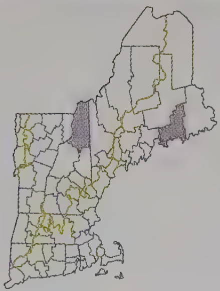
Distinguishing features:
A. Frontal lobes evenly rounded
B. Lamella at scape bend large and spoon shaped (cf. *M. nearctica*)
C. Scape uniformly wide (cf. *M. detritinodis* group)

Myrmica

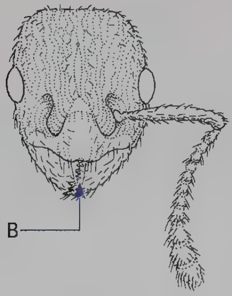
Myrmica brevispinosa Wheeler, 1917

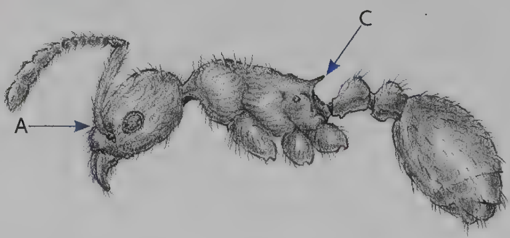
The Short-spined Ant

Refers to its propodeal spines: *brevis* (Lat: short) + *spina* (Lat: thorny).



Habitat: Boreal forests; nests under rocks and in sandy soils.
Geographic range: Canada, Alaska, North Dakota; high elevations in the western mountains as far south as New Mexico. In New England, recorded only from New Hampshire's White Mountains and Down East Maine.
Natural history: Scavenges dead insects for food. Production of queens is enhanced when the colony obtains additional carbohydrates.
Look-alikes: Unmistakable with its combination of short spines and notched clypeus.





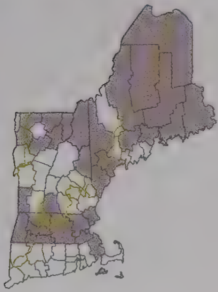
Distinguishing features:
A. Scape gently curved to insertion
B. Clypeus distinctly notched
C. Spines unusually short (cf. *M. lobifrons*)

Myrmica

Myrmica detritinodis Wheeler, 1917

The Eroded or Detrital Ant

Refers to its unsculptured petiole or its habitat: *detritus* (Lat: worn away or of the Earth).

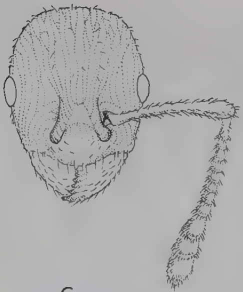


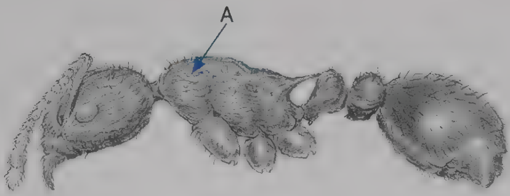
Habitat: Boreal cool coniferous and mixed deciduous forests; nests in soil, under moss, or under moist lichens.

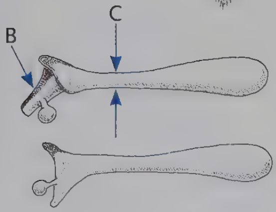
Geographic range: Throughout Canada, Alaska, the upper Midwestern United States; west to North Dakota; high elevations in the western mountains south into New Mexico.

Natural history: A good indicator of mature forests, it also nests in clear-cuts, recent fire scars, and other disturbed areas if competitively dominant ant species are absent.

Look-alikes: *M. fracticornis;* size of the antennal lamina and sculpturing on the petiole distinguish them. Favored habitats differ, but they will co-occur.







Distinguishing features:

A. Mesosomal rugae wavy, anastomosed, triangular in cross section

B. Scape sharply bent to insertion; lamina continues down scape base

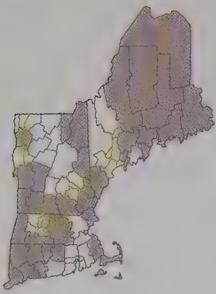
C. Scape tapered basally (cf. *M. nearctica* group)

Myrmica

Myrmica fracticornis Forel, 1901

The Broken-horned Ant

Refers to the angled base of its antenna: *fractus* (Lat: broken) + *cornu* (Lat: horn).

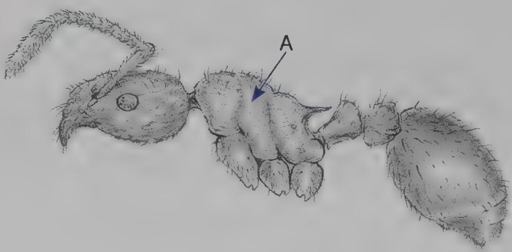


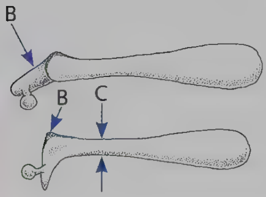
Habitat: Nests in moist soils of shrubby woodlands, forest edges, stream margins, and river banks.

Geographic range: Eastern Canada south to Tennessee; geographically separated (disjunct) records from the Ozark Mountains west to the Rocky Mountains.

Natural history: Feeds on honeydew from tended aphids and lacewings.

Look-alikes: *M. detritinodis;* size of antennal lamina and sculpturing on petiole distinguish them. Favored habitats differ, but they will co-occur.





Distinguishing features:

A. Mesosomal rugae wavy, anastomosed, triangular in cross section

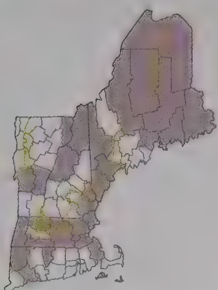
B. Scape sharply bent to insertion; small lamina not extended down the base of the scape

C. Scape tapered basally (cf. *M. nearctica* group)

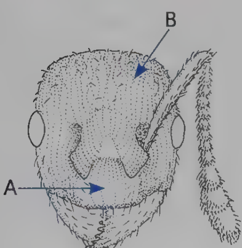
Myrmica incompleta Provancher, 1881

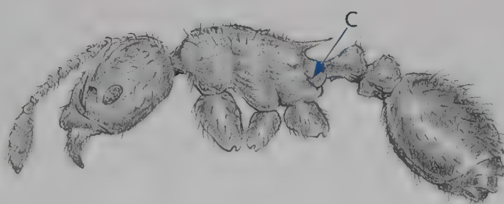
The Incomplete Ant

Named for the incomplete ridges on the wings at the base of the propodeum.



Habitat: Deciduous forests; nests in moist soil and moss mounds.
Geographic range: Canada and Alaska; lower United States south to New Jersey; west to Nevada.
Natural history: Feeds on honeydew of root-feeding aphids and scale insects. Host of the trophic parasite *Formicoxenus provancheri*. Brood preyed on by larvae of the myrmecophilous syrphid fly *Microdon albicomatus*, which live in *M. incompleta* nests.
Look-alikes: *Myrmica alaskensis;* a concave clypeal margin, bulging clypeus, and netlike rugae on the head identify *M. incompleta*.



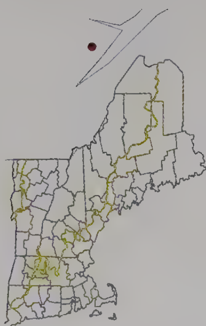


Distinguishing features:
A. Clypeus bulges out; clypeal margin is even or shallowly concave.
B. Rugae atop the head are netlike.
C. Basal propodeal ridge does not reach bottom of propodeal wing.

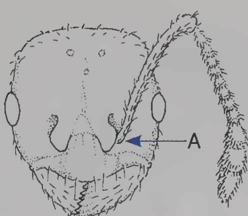
Myrmica lampra Francoeur, 1968

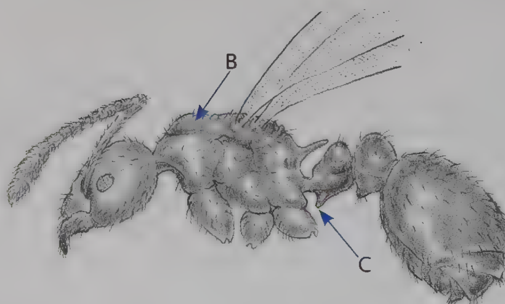
The Bright Ant

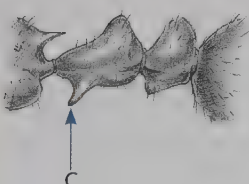
Refers to its unsculptured mesosoma: *lampros* (Gk: bright).



Habitat: Boreal forest soils; nests with its host, *M. alaskensis*.
Geographic range: Unknown; recorded from only two locations in Quebec. Look for it Maine, with *M. alaskensis*.
Natural history: This workerless inquiline social parasite of *M. alaskens* depends on its host to rear and care for its queens and males.
Look-alikes: None. Unmistakably bright and shiny with a large, conica subpetiolar process.





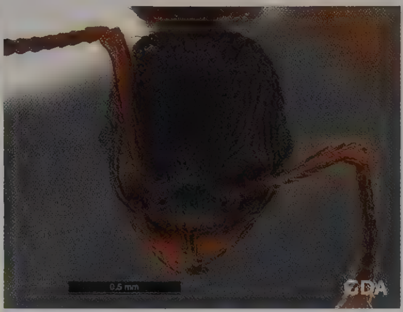


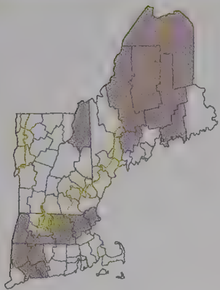
Distinguishing features:
A. Scape gently curved to insertion
B. Body bright, shiny, lacking sculpturing (cf. *M. alaskensis*)
C. Subpetiolar process large, conical (cf. *M. quebecensis*)

Myrmica latifrons Stärke, 1927

The Wide-faced Ant

Refers to the ratio of its head width to the distance between its frontal lobes: *latus* (Lat: wide) + *frons* (Lat: front).



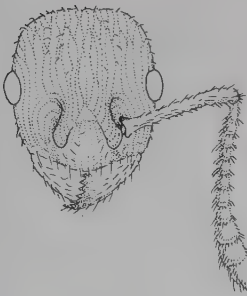


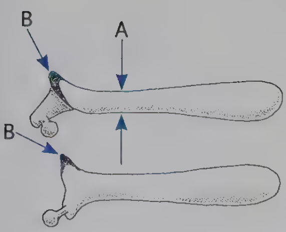
Habitat: Nests in moist, shady soils in shrubby woodlands and open fields.

Geographic range: The Canadian Maritime Provinces west to Manitoba; south to Georgia in the east, Arizona in the west. Disagreement over the correct name of this species—it is referred to as *M. latifrons* or *M. emeryana* Cole—makes the geographic range boundaries suspect.

Natural history: Omnivorously feeds on fruit, nectar, and dead insects.

Look-alikes: *Myrmica nearctica*–group species; the lobed subpostpetiole identifies *M. latifrons*.





Distinguishing features:

A. Scape uniformly wide (cf. *M. detritinodis* group)

B. Lamina small (cf. *M. nearctica*, *M.* sp. AF-eva)

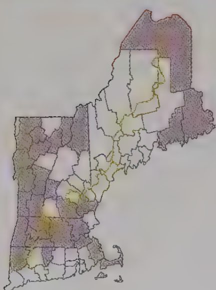
C. Ventral postpetiolar lobe projecting forward (cf. *M. nearctica* group)

Myrmica

Myrmica lobifrons Pergande, 1900

The Lobe-fronted Ant

Refers to its large frontal lobes: *lobus* (Lat: lobe) + *frons* (Lat: front)

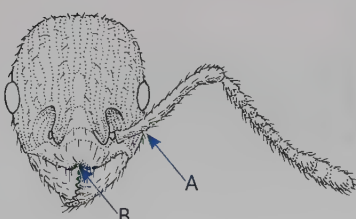


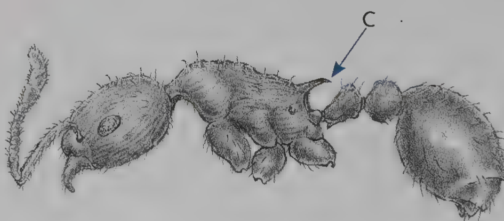
Habitat: Bogs and nutrient-poor fens.

Geographic range: Unknown due to historical misunderstanding of it identity. At least Canada, Alaska, and New England except for Rhode Island.

Natural history: One of the most common ants nesting in northern bogs, *M. lobifrons* is the primary prey of the Northern Pitcher Plant, *Sarracenia purpurea*. Our studies of the interaction between *Myrmica lobifrons* and pitcher plants led us to write this field guide!

Look-alikes: Unmistakable. The only bog-inhabiting *Myrmica* with a deeply notched clypeus.





Distinguishing features:

A. Scape gently curves to insertion.

B. Clypeus is deeply notched.

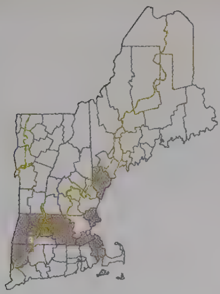
C. Propodeal spines point rearward and upward at ~45°; tips curve gently downward (cf. *M. brevispinosa*).

Myrmica

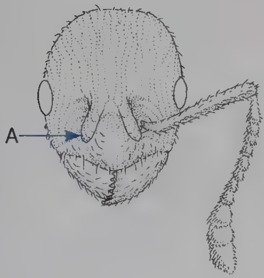
Myrmica nearctica Weber, 1939

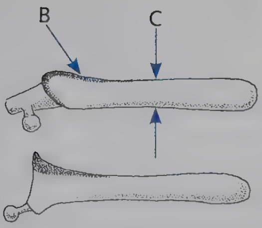
The Nearctic Ant

Named for its collection in North America, originally as a subspecies of the Palearctic *Myrmica sabuleti*.



Habitat: Mixed deciduous forests; nests under rocks, logs, stumps.
Geographic range: Quebec and Manitoba south to North Dakota and Colorado.
Natural history: Plays dead when disturbed.
Look-alikes: *Myrmica americana, M. detritinodis*–group species; the uniformly wide scape separates the species groups; the droopy frontal lobes and horizontal extension along the scape of the antennal lamella exclude *M. americana.*





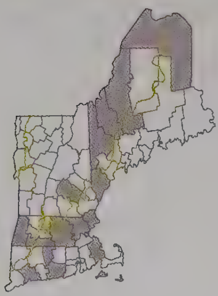
Distinguishing features:
A. Frontal lobes more rounded at base than at top (cf. *M. americana*)
B. Large lamella extends horizontally along scape (cf. *M. americana*).
C. Scape uniformly wide (cf. *M. detritinodis* group)

Myrmica

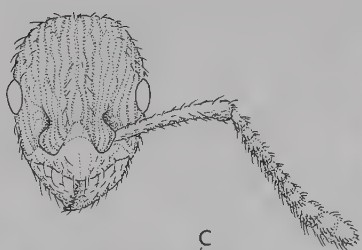
Myrmica pinetorum Wheeler, 1905

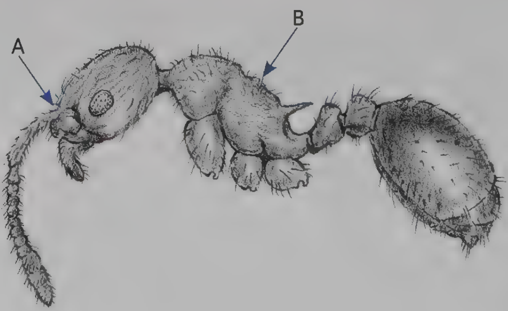
The Ant of the Pines

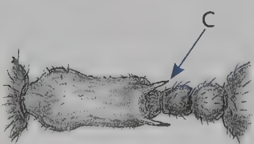
Refers to its type locality in the New Jersey Pine Barrens: *pinus* (Lat: pine).



Habitat: Nests in soils of pine forests, mixed deciduous forests, pine barrens.
Geographic range: Northern New England and Quebec; south to the Carolinas and the Gulf Coast; west to Oklahoma.
Natural history: Makes very small colonies in mostly sandy soils.
Look-alikes: *Myrmica punctiventris, M. rubra;* larger frontal lobes and stepped-down pronotum eliminate *M. rubra*. As *M. pinetorum* was once considered a subspecies of *Myrmica punctiventris*, differences between them are subtle: *M. pinetorum* has relatively wide, short propodeal spines and frontal lobes that are flattened, curve slightly downward at the edges, and cover antennal bases.







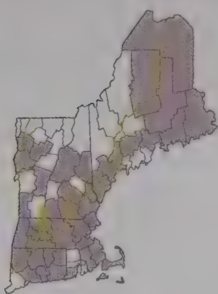
Distinguishing features:
A. Scape gently curved to insertion; insertions covered by frontal lobe
B. Propodeum lower than promesonotum (cf. *M. incompleta* group)
C. Propodeal spine length ≤ distance between them (cf. *M. punctiventris*)

Myrmica

Myrmica punctiventris Roger, 1863

The Punctured Ant

Refers to the punctate hairs on its gaster: *punctus* (Lat: pricked, punctured) + *ventris* (Lat: belly).

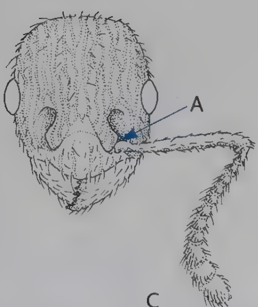


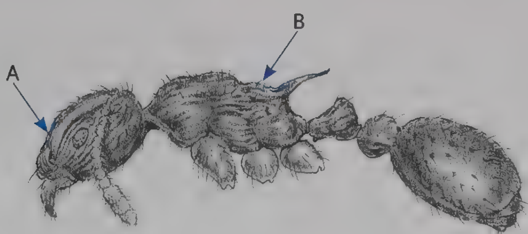
Habitat: Mixed deciduous forests; nests under bark of standing and fallen dead trees, in rotten logs and leaf litter, in soil under rocks, and in empty shells of nuts.

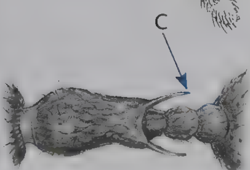
Geographic range: New England and Quebec south to Georgia; west to Arkansas, Nebraska.

Natural history: Our most common forest-dwelling *Myrmica;* an important disperser of seeds of spring-flowering forest herbs.

Look-alikes: *Myrmica pinetorum, M. rubra;* larger frontal lobes and stepped-down pronotum eliminate *M. rubra*. The propodeal spines of *M. punctiventris* are long and wavy, like the horns of a long-horned steer, and the spines are longer than the distance between their bases; its frontal lobes are angled up, revealing the antennal bases.







Distinguishing features:

A. Scape gently curved to insertion; insertions not covered by frontal lobes

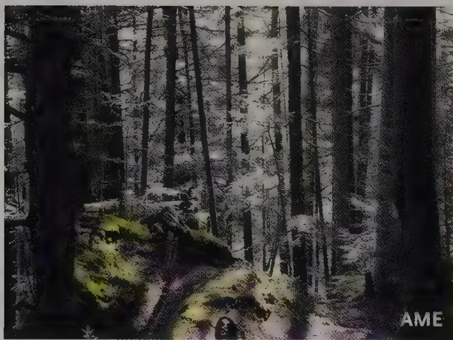
B. Propodeum lower than promesonotum (cf. *M. incompleta* group)

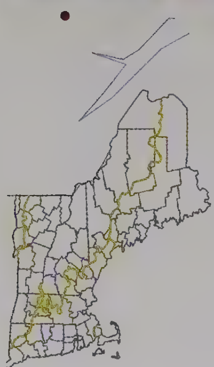
C. Propodeal spine length > distance between them (cf. *M. pinetorum*)

Myrmica quebecensis Francoeur, 1981

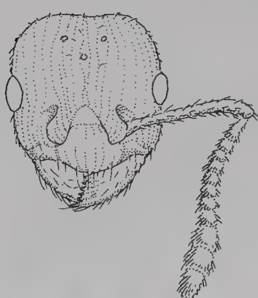
The Québécois Ant

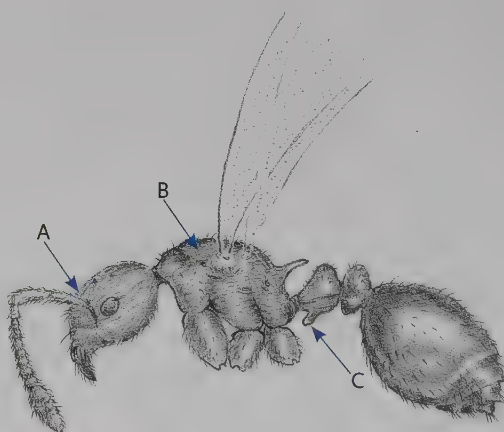
Named for its type locality in Quebec, Canada.

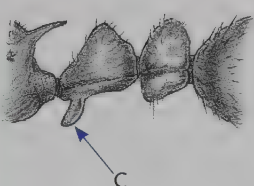




Habitat: Boreal forest soils; nests with its host, *M. alaskensis*.
Geographic range: Southern Canada. Could be collected with its host in Maine and throughout North America's boreal forests.
Natural history: This workerless inquiline social parasite of *M. alaskensi* depends on its host workers to rear and care for its queens and males.
Look-alikes: Unmistakable with its large, rectangular subpetiolar process.







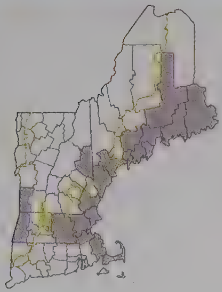
Distinguishing features:

A. Scape gently curved to insertion
B. Body bright, shiny, lacking heavy sculpturing (cf. *M. alaskensis*)
C. Subpetiolar process large, rectangular (cf. *M. lampra*)

Myrmica rubra (Linnaeus, 1758)

*The European Fire Ant

Refers to its color: *ruber* (Lat: red).

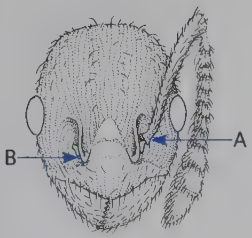


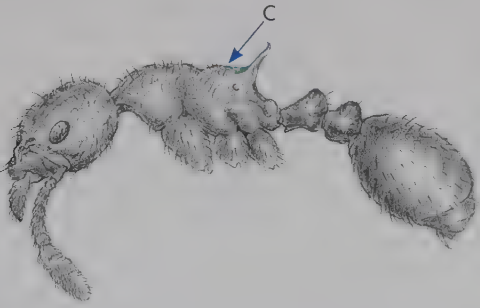
Habitat: Nests in soil and under flat stones in wet places: streamsides, river margins, marshes.

Geographic range: Native range: Europe and western Siberia. In North America: Newfoundland, Nova Scotia, Quebec, Ontario, British Columbia; all New England states except Connecticut.

Natural history: Introduced into the United States at the Arnold Arboretum (Massachusetts) in the early 1900s. In recent years, its range has extended dramatically along coastal New England, where it annoys picnickers on beaches; it is now considered an invasive species of management concern. In Europe, it is the host for a near-threatened butterfly, the Dusky Large Blue (*Phengaris nausithous*). Like other myrmecophilic Lycaenidae, the butterflies' larvae are cared for by the host ant, but after the adults emerge from their cocoons, they have to quickly escape the ant nest before the ants attack and tear apart the butterflies.

Look-alikes: *Myrmica pinetorum, M. punctiventris*; the small, thin frontal lobes of *M. rubra* point straight up.





Distinguishing features:

A. Scape gently curved to insertion

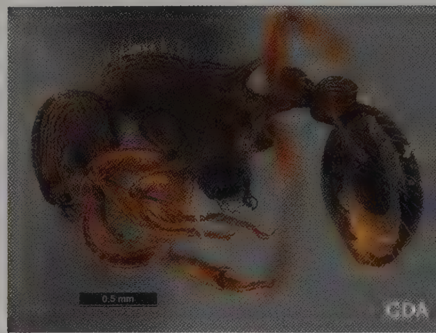
B. Small, thin frontal lobes pointing upward (cf. *M. punctiventris*, *M. incompleta* groups)

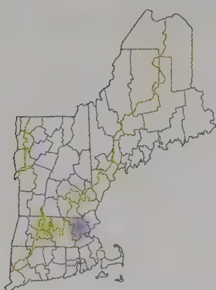
C. Propodeum level with pronotum (cf. *M. punctiventris* group)

Myrmica scabrinodis Nylander, 1846

The Scabrous Ant

Refers to its roughly sculptured petiole: *scabres* (Lat: rough, scabby) + *nodus* (Lat: lump).



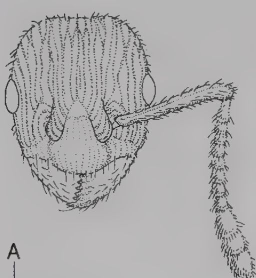


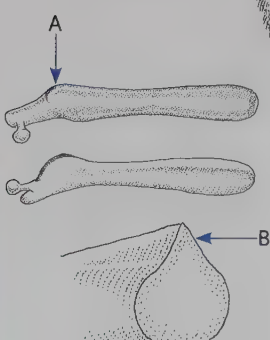
Habitat: Open fields and woodlands; nests in soil, under bark, in and under moss.

Geographic range: Native range: Europe into Asia Minor, northern Kazakhstan, western Siberia. Found in abundance by Adam Clark on the Boston Harbor Islands (2007, 2008) and by Daniella Prince in her Porter Square backyard (2011).

Natural history: In Europe, preys on larvae of *Lasius flavus*. Unstudied in North America.

Look-alikes: *Myrmica sculptilis*–group species; the heavy sculpturing and antennal scapes triangular in cross section distinguish *M. scabrinodis*.





Distinguishing features:

A. Scape sharply bent to insertion

B. Scape triangular in cross section (cf. *M.* sp. AF-scu)

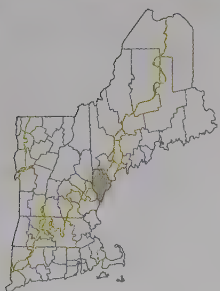
C. Sculpturing on body heavy and scabrous

Myrmica

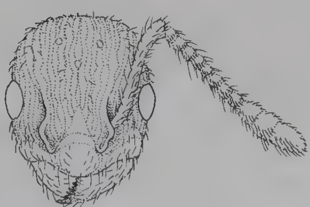
Myrmica semiparasitica Francoeur, 2007

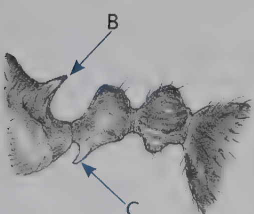
The Partially Parasitic Ant

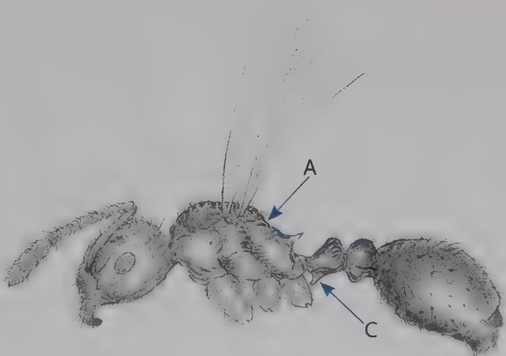
Refers to its life history: *semi-* (Lat: in part) + *parasitus* (Lat: guest or parasite).



Habitat: Mixed deciduous and coastal forests; nests with its supposed host, *M. punctiventris*.
Geographic range: Unknown. This species was first described in 2007, and has been collected so far only from Long Island, Nantucket, southern Maine, Ohio, and several localities in Canada.
Natural history: Hypothesized to be a temporary inquiline social parasite of *M. punctiventris*.
Look-alikes: *Myrmica pinetorum, M. punctiventris;* the parasite is identified by its relatively small size; small, thick propodeal spines; and large, triangular subpetiolar process.

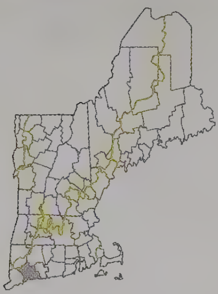




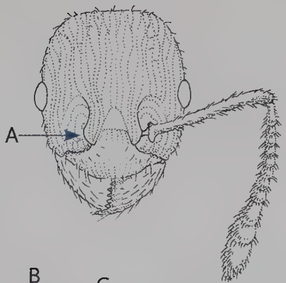


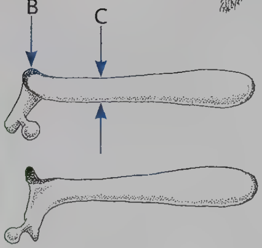
Distinguishing features:
A. Propodeum lower than promesonotum (cf. *M. incompleta* group)
B. Small, thick propodeal spines (cf. *M. pinetorum, M. punctiventris*)
C. Pronounced triangular subpetiolar process (cf. *M. pinetorum, M. punctiventris*)

An undescribed species of *Myrmica*, species code AF-eva



Habitat: Disturbed habitats such as parking lots and old fields.
Geographic range: Unknown. Collected from the Thimble Islands off the coast of Guilford, Connecticut, and in Hyde Park, New York.
Natural history: Unknown. This undescribed species resembles the western and central North American species *Myrmica evanida,* which may be expanding its range. In the Midwestern states, this species (or one that looks just like it) is very abundant in grasslands and prairies and has long been misidentified and even considered the typical form of *Myrmica americana.*
Look-alikes: *Myrmica nearctica*–group species; André Francoeur provisionally places *M.* sp. AF-eva in the *nearctica* group, distinguished from *M. americana* by its small, barely spoonlike antennal lamella.

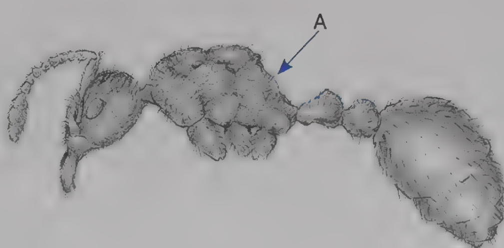


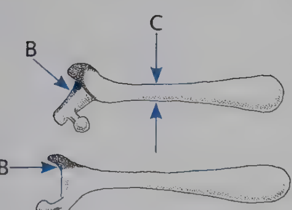


Distinguishing features:
A. Frontal lobes evenly rounded (cf. *M. nearctica*)
B. Small, barely spoon-shaped lamella (cf. *M. americana*)
C. Scape uniformly wide (cf. *M. detritinodis* group)

Another undescribed species of *Myrmica*, species code AF-ine

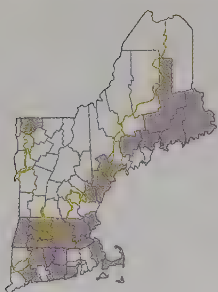
Habitat: Collected from a single blueberry barren in Down East Maine.
Geographic range: Unknown. The only record is of a single queen collected in a pitfall trap in Washington County, Maine.
Natural history: Based on its small size and the absence of spines, this species is thought to be an inquiline social parasite. The shape of the antennal flange suggests that it is in the *detritinodis* or *sculptilis* group, but more specimens are needed to make a definitive decision.
Look-alikes: Unmistakable; the only New England *Myrmica* species without propodeal spines.





Distinguishing features:
A. Lacks propodeal spines (cf. other *M. detritinodis* group species)
B. Scape sharply bends to insertion; curved lamina extends down base.
C. Scape tapers basally (cf. *M. nearctica* group).

A third undescribed species of *Myrmica*, species code AF-scu

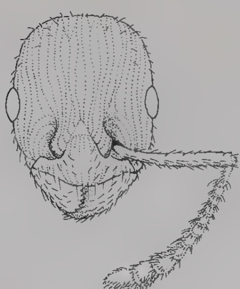


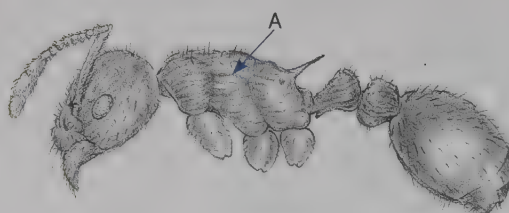
Habitat: Deciduous and mixed forests.

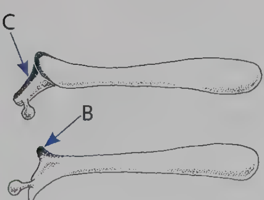
Geographic range: Unknown but widespread in New England, the northern Mid-Atlantic states, southeastern Canada.

Natural history: Unknown. It is common in forest habitats; study it, and contribute to our knowledge of ants!

Look-alikes: *Myrmica detritinodis*, *Myrmica* sp. AF-smi; thick rugae eliminate *M. detritinodis*; *M.* sp. AF-scu has a smaller antennal lamina than *M.* sp. AF-smi.







Distinguishing features:

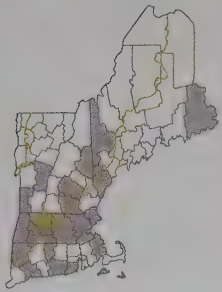
A. Thick parallel rugae are rounded in cross section (cf. *M. detritinodis*).

B. Scape sharply bends to insertion.

C. Small dorsal lamina continues down scape base (cf. *M.* sp. AF-smi).

Myrmica

A fourth undescribed species of *Myrmica*, species code AF-smi

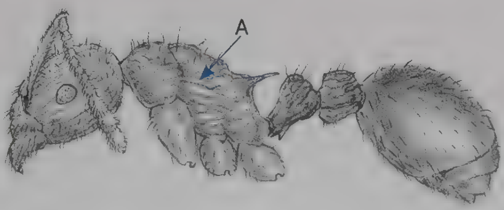


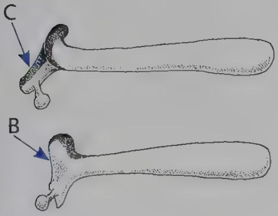
Habitat: Deciduous and mixed forests.

Geographic range: Unknown but widespread in New England, the northern Mid-Atlantic states, southeastern Canada.

Natural history: Unknown. It is common in warm forest habitats. Find it, watch it, and learn about it!

Look-alikes: *Myrmica detritinodis*, *Myrmica* sp. AF-scu; thick rugae eliminate *M. detritinodis; M.* sp. AF-smi has a much larger antennal lamina than *M.* sp. AF-scu.





Distinguishing features:

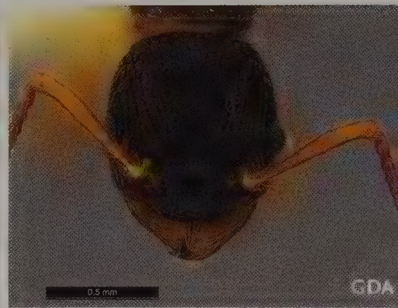
A. Thick parallel rugae are rounded in cross section (cf. *M. detritinodis*).

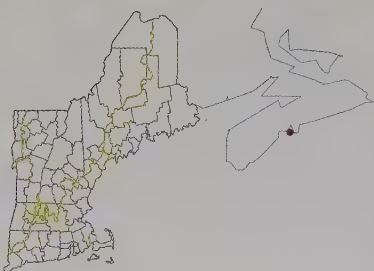
B. Scape sharply bends to insertion.

C. Large dorsal lamina continues down scape base (cf. *M.* sp. AF-scu).

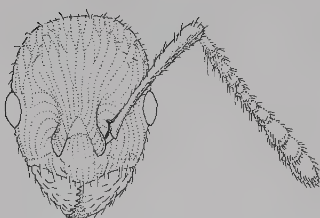
Myrmica

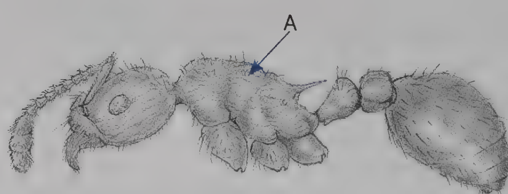
A fifth undescribed species of *Myrmica*, species code AF-sub

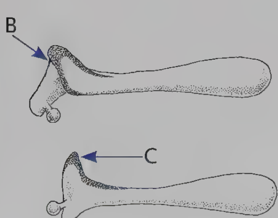




Habitat: Sandy soils of sparsely vegetated granitic bedrock.
Geographic range: Unknown. Recorded from the souther shores of Hudson Bay; Goose Bay Air Force Base in Centra Labrador; Peggy's Cove outside of Halifax, Nova Scotia. No yet collected in New England; start looking in Down East Maine.
Natural history: Unknown. Its presence at airfields and in locations geographically disparate from its supposed home range near Hudson Bay suggests that it can disperse widely.
Look-alikes: *Myrmica detritinodis, M.* sp. AF-smi; distinguish it by its unusually large antennal lamina and anastomosing rugae.







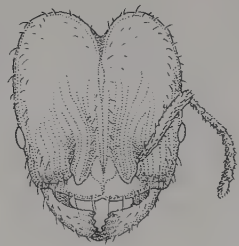
Distinguishing features:
A. Mesosomal rugae are wavy, anastomosed, triangular i cross section (cf. *Myrmica* sp. AF-smi).
B. Scape sharply bends to insertion.
C. Very large, curved dorsal lamina

Myrmica

Pheidole Westwood, 1839

The Thrifty Ants

From the Greek *pheidos*, meaning thrifty or saving and referring to its habit of harvesting and storing seeds

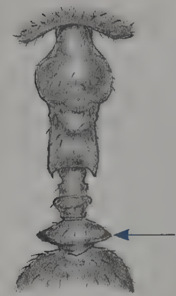


Pheidole is a one of the most diverse genera of ants in the world—Professor E. O. Wilson refers to it as a dominant, hyperdiverse genus. More than 1,100 species are currently recognized, at least 100 of which occur in North America. However, *Pheidole* is primarily a tropical and warm-temperate genus, and only one species, *P. pilifera,* extends its native range into New England. A second species, *P. flavens,* is a widespread tropical species that has been recorded from a greenhouse in New Hampshire. Overall, the genus is easily recognized by its dimorphic workers—the majors have unusually enlarged heads, like the Talosians in *The Cage,* the very first pilot episode of the original *Star Trek* television series (they reappear in *The Menagerie* later in the first season). In New England, it is the only genus with the combination of a three-segmented antennal club (most apparent on minor workers), a propodeum that is stepped down relative to the level of the mesonotum, and propodeal spines.

Identifying the Species of *Pheidole*

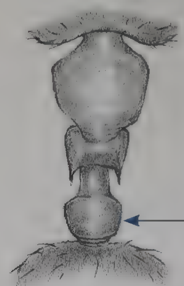
If you have collected a *Pheidole* out of doors in New England, it is almost certainly *P. pilifera*. Our native species can be distinguished from the subtropical *P. flavens* by two characters. First, the postpetiole of major workers of *P. pilifera,* viewed from above, is nearly diamond shaped, and the corners are quite sharp. In contrast, the postpetiole of major workers of *P. flavens* is round. Second, the sculpturing on the head and mesosoma of *P. pilifera* is linear and more or less parallel, whereas the sculpturing on the head and mesosoma of *P. flavens* is granular—almost honeycombed in appearance. This difference is most apparent in minor workers, which conveniently are the ones most frequently collected. A third species that occurs in the Mid-Atlantic states and farther south (but not included in this guide) is *P. tysoni*. *Pheidole tysoni* resembles *P. flavens,* but neither the major workers nor the minor workers of *P. tysoni* have any sculpturing, granular or otherwise, on their heads.

Key to the Species of *Pheidole*



Rhomboid postpetiole of
P. pilifera major workers

1a. **In dorsal view, the postpetiole of the major workers is more or less diamond shaped, with sharp corners**; the ant is brown; it is our only native New England species .... *P. pilifera*, p. 304



Oval postpetiole of
P. flavens major workers

1b. **In dorsal view, the postpetiole of the majors is more or less round or oval shaped, lacking sharp corners**; the ant is yellow; it is a tropical species encountered in New England only indoors .... *P. flavens*, p. 303

Easily Confused Species

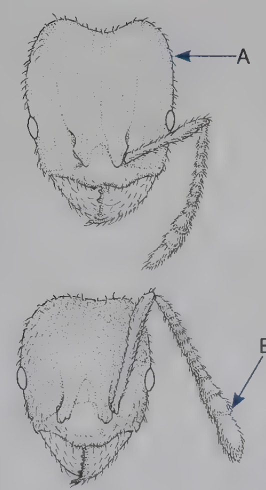
Both *Pheidole* and *Aphaenogaster* species have similarly shaped mesosomas in which the propodeum is much lower than the promesonotum, giving it a stepped-down or broken-backed appearance. *Aphaenogaster* on average is much larger than *Pheidole*. The three-segmented antennal club, along with the unusually large head in the major workers of *Pheidole*, reliably distinguishes *Pheidole* from *Aphaenogaster*. It is also possible to confuse *P. pilifera* minors with *Tetramorium caespitum*, but *P. pilifera* does not have the strongly parallel rugae of *T. caespitum*, nor does it have a deep antennal socket.

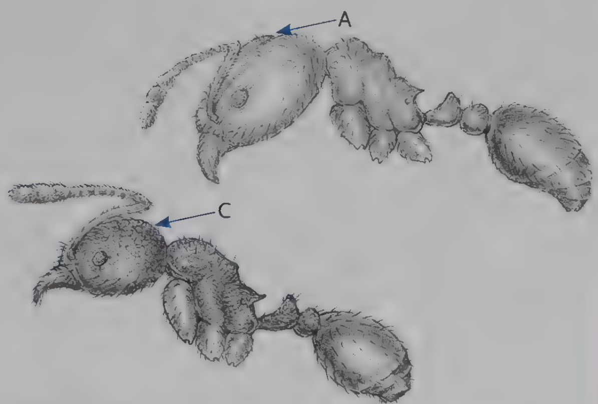
Pheidole flavens Roger, 1863

The Yellow *Pheidole*

Refers to its color: *flavus* (Lat: yellow).

Habitat: Nests in soil, small rotten branches, and flowerpots and under rocks.
Geographic range: Florida, the Caribbean Islands and Central America, tropical and subtropical South America. In New England, it can survive only in heated spaces such as greenhouses; as far as we know, it has been recorded only from a greenhouse in New Hampshire.
Natural history: This omnivorous species feeds on smaller arthropods such as mites, nectar, and other plant secretions.
Look-alikes: *Aphaenogaster tennesseensis, P. pilifera;* its 3-segmented antennal club eliminates *Aphaenogaster.* Postpetiolar shape (viewed dorsally) and sculpturing on minor workers distinguish the two *Pheidole* species. *Pheidole flavens* also looks very similar to *P. tysoni,* which can be collected in the Mid-Atlantic states and farther south, but the heads of *P. tysoni* workers lack granular sculpturing.



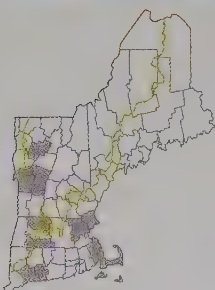


Distinguishing features:
A. Greatly enlarged heads of major workers (cf. *Aphaenogaster*)
B. Antennal club with 3 segments (cf. *Aphaenogaster*)
C. Granular, honeycombed sculpturing of minor workers (cf. *P. pilifera*)

Pheidole pilifera (Roger, 1863)

The Hairy *Pheidole*

Refers to its hairiness: *pilos* (Gk: hair) + *ferre* (Gk: to bear).

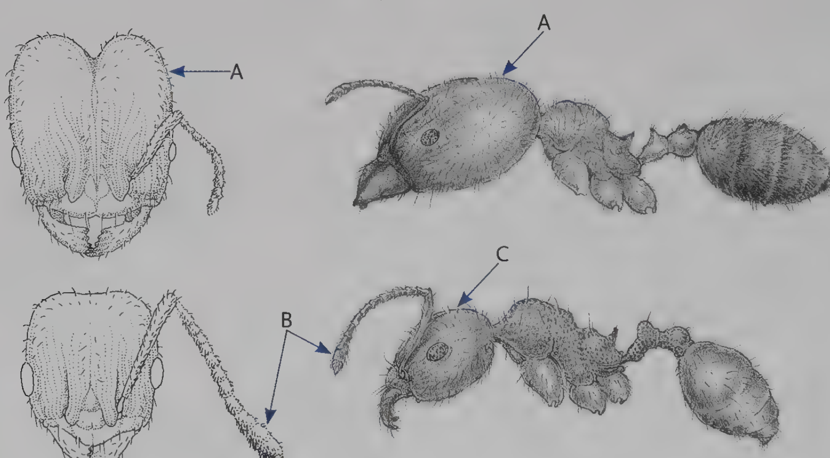


Habitat: Nests in exposed sandy soils with a little bit of clay in grasslands and other open habitats.

Geographic range: Vermont south to Florida; west to eastern Colorad

Natural history: The most widespread Nearctic species of *Pheidole* and the only species in the genus whose native range extends into New England. Makes small craterlike nests; collects and harvests seeds tha it stores in its nest chambers. Major workers are rarely collected outside of the nest.

Look-alikes: *Aphaenogaster rudis*–group species, *P. flavens*. Size and 3-segmented antennal club eliminate *Aphaenogaster;* postpetiolar shape (viewed dorsally) and sculpturing on minor workers distinguish the two *Pheidole* species.



Distinguishing features:

A. Greatly enlarged heads of major workers (cf. *Aphaenogaster*)

B. Antennal club with 3 segments (cf. *Aphaenogaster*)

C. Linear sculpturing of minor workers (cf. *P. flavens*)

Protomognathus Wheeler, 1905

The Ancestral Partially Jawed Ant

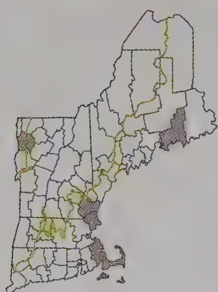
From the Greek *pro*, meaning before, + *tomos*, meaning part (of a book), + *gnathos*, meaning jaw and referring to its ancestral phylogenetic position relative to the European *Tomognathus*

The Nearctic genus *Protomognathus* has only one species. Its European counterpart was named *Tomognathus* for its partial (i.e., untoothed) mandibles, and *Protomognathus* was thought to be the ancestor of *Tomognathus*. However, the name *Tomognathus* (given to ants in 1861) had been used in 1850 to name another genus—of fossil fish with reduced jaws—so the rules of nomenclature demanded a new name. Forel renamed *Tomognathus* as *Harpagoxenus* in 1893 (see page 242), so *Protomognathus* ought to have been named *Proharpagoxenus*. However, in 1905 William Wheeler apparently was unaware of the earlier nomenclatural change and named it *Protomognathus*. In 1924 Carlo Emery not only recognized Wheeler's nomenclatural error but also transferred *Protomognathus* into the genus *Harpagoxenus*. In 1990, *Protomognathus* was restored to its current status as its own genus by Hölldobler and Wilson in their Pulitzer Prize–winning book *The Ants*. The genus *Protomognathus* and its only species, *P. americanus*, is easily recognized by the pronounced grooves (scrobes) on either side of the frontal lobes in which the antennae nestle, and by the four teeth on its mandibles. *Protomognathus* enslaves acorn-nesting ants in the genus *Temnothorax;* for this reason, it is sometimes referred to as the Pirate Ant.

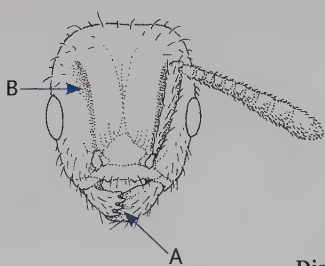
Protomognathus americanus (Emery, 1895)

The American *Protomognathus*

Named for America, in contrast to its closely related European cousins.



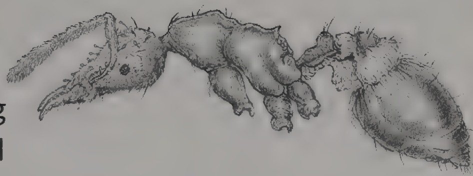
Habitat: Nests in acorns and other small cavities, including hollow stems of milkweeds (*Asclepias* species) and dogbanes (*Apocynum* species), with its hosts, ants in the genus *Temnothorax*.
Geographic range: Eastern North America and southeastern Canada.
Natural history: Raids colonies of its hosts, *Temnothorax ambiguus*, *T. curvispinosus*, and *T. longispinosus*, and carries off the brood to its own nest, where *Temnothorax* workers continue to rear the brood.
Look-alikes: *Cardiocondyla*, *Formicoxenus*, *Harpagoxenus*, *Leptothorax*, *Temnothorax*; *Protomognathus* has distinctive pronounced antennal scrobes and four mandibular teeth.



Distinguishing features:
A. Mandibles with 4 teeth (cf. *Formicoxenus*, *Harpagoxenus*)
B. Pronounced antennal scrobes (cf. *Leptothorax*, *Temnothorax*)

Pyramica Roger, 1862

The Angular Ants



From the Greek *pyramis,* meaning an angular structure or a pyramid and referring either to the triangular head and mandibles or to the strongly angular pronotum

The genus *Pyramica* is a diverse, mainly tropical and subtropical genus of approximately 350 species of ants. *Pyramica* species are inconspicuous and difficult to find because they make very small colonies in leaf litter, topsoil, or rotten wood. But these species are widespread and worth looking for so that you can enjoy their unique appearance. Their triangular and strongly lobed heads, six-segmented antennae, and elaborate spongy "skirts" just behind the postpetiole at the base of the first segment of the gaster give our three New England species (out of a total of approximately 40 North American species) a decidedly Lady Gaga–esque appearance.

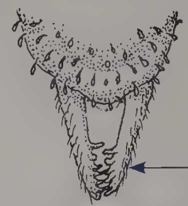
There is a long-running argument about the correct name of this genus. Julius Roger described it in 1862 but one year later subsumed it within the closely related *Strumigenys,* where it resided until 1948. In that year Bill Brown restored it to full generic status, only to return it to *Strumigenys* 11 years later. In 1999 Barry Bolton revived *Pyramica,* and since then he and Cesare Baroni Urbani have been sparring in the literature over whether it should remain *Pyramica* or be returned to *Strumigenys*. The basis of the disagreement is whether the two genera are one because neither can cross their mandibles or should be separated based on whether the mandibles hold fast the prey until the ant stings it to death (*Pyramica*) versus whether the mandibles directly kill the prey and it need not be stung (*Strumigenys*). To add to the confusion, in the late 1940s some of our *Pyramica* (or *Strumigenys*) species were further separated out into the genus *Smithistruma,* where they are still found in Gary Coovert's *The Ants of Ohio*. Bolton recognized that the name *Smithistruma* was used later than the name *Pyramica,* so by the abstruse rules of nomenclature, *Pyramica* must prevail. We follow Bolton here. However, the disagreement in the literature persists and will not be resolved without molecular data.

Identifying the Species of *Pyramica*

All three New England species of *Pyramica* can be distinguished easily by facial characters, but because the ants are small, these characters can be seen only at high magnification: 25–50×. *Pyramica pergandei* has only a few teeth on the lower (anterior) portion of its mandibles, whereas the other two

species of *Pyramica* have teeth along the entire edge of the mandibles. Next, look at the spoon-shaped hairs on the margin of the clypeus. In *P. metazytes,* these hairs all curve in toward the mandibles, but in *P. pulchella* the first pair of hairs on the clypeal margin curve away from the mandibles.

Key to the Species of *Pyramica*



Elongate mandibles with anterior teeth of *P. pergand*

1a. In full-face view, **the mandibles are elongate and narrow, with teeth only on the anterior third to half of the mandibles;** the 1st (basal) and 3rd mandibular teeth are sharp, but the 2nd mandibular tooth is broad and blunt .... *P. pergandei,* p. 310

1b. In full face view, **the mandibles are triangular to elongate, with teeth along the entire surface** except for a small gap between the clypeus and the basal tooth 2

In-curved clypeal hairs of *P. metazytes*

2a (1b). **The hairs on the clypeal margins, both lateral and anterior, curve toward the mandibles; the paired erect hairs on the dorsum, mesonotum, and 1st gastral segment are long, straight, and sharp;** the antennal hairs are curved; the antennal hairs closest to the base of the scape have broad, rounded (spatulate) ends .... *P. metazytes,* p. 309

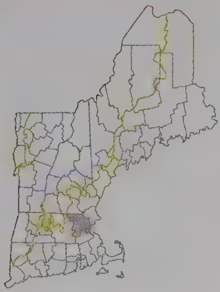
Out-curved clypeal hairs o *P. pulchella*

2b. **The hairs on the lateral clypeal margins curve toward the mandibles, but those on the anterior margin curve away from the mandibles; the paired erect hairs on the dorsum, mesonotum, and 1st gastral segment are short and whiplike (flagellate);** the antennal hairs are curved and spatulate .... *P. pulchella,* p. 311

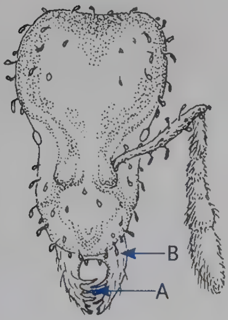
Pyramica metazytes Bolton, 2000

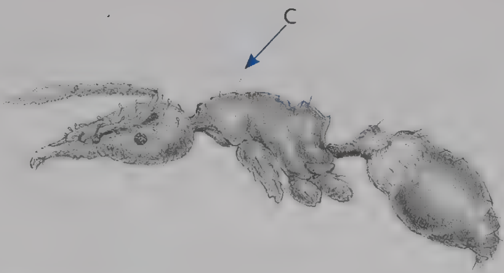
The Euphonious *Pyramica*

Refers to nothing at all: according to Bolton, *metazytes* is an "arbitrary combination of particularly euphonious letters."



Habitat: Nests in the litter layer of hardwood forests and, in the south-eastern United States, in the litter of loblolly and shortleaf pines.
Geographic range: Massachusetts south along the eastern coastal plain to Mississippi.
Natural history: This sit-and-wait predator quickly snaps shut its wide-open jaws on small springtails (Collembola) that contact the tiny trigger hairs between its mandibles. After it catches the prey, it stings them to death.
Look-alikes: *Pyramica pulchella;* size and shape of erect hairs and position of hairs on the clypeal margin distinguish them.



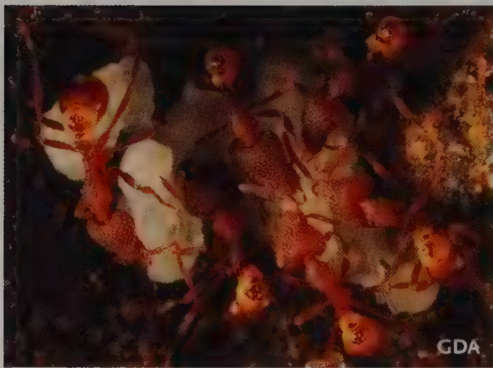


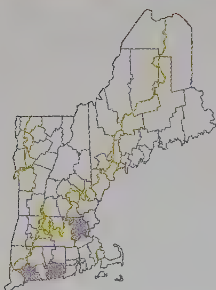
Distinguishing features:
A. Mandibles have teeth along most of inner margins.
B. Hairs on clypeal margins all curve inward (cf. *P. pulchella*).
C. Erect dorsal hairs are long, straight, sharp (cf. *P. pulchella*).

Pyramica pergandei (Emery, 1895)

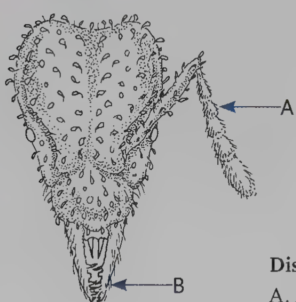
Pergande's *Pyramica*

Honors its collector, American entomologist Theodore Pergande (1840–1916).





Habitat: Open woodlands; nests in rotten logs and soil and under rocks.
Geographic range: Massachusetts south to the Carolinas; west to Missouri, Kansas.
Natural history: This is the largest and most frequently collected *Pyramica* in New England. It is a specialist feeder on springtails (Collembola).
Look-alikes: *Pyramica metazytes, P. pulchella;* mandibular teeth distinguish them.

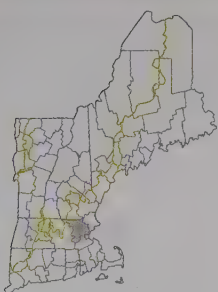


Distinguishing features:
A. Antennae with 6 segments
B. Teeth only anteriorly on mandibles (cf. *P. metazytes, P. pulchella*)
C. Pronounced spongy "skirt" at base of petiole and postpetiole

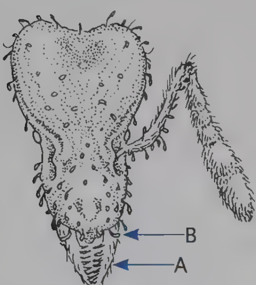
Pyramica pulchella (Emery, 1895)

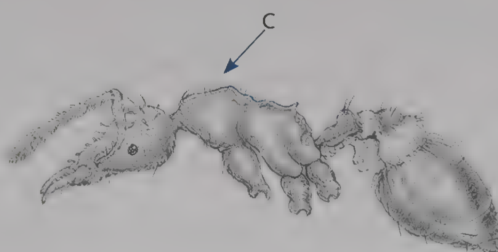
The Beautiful *Pyramica*

Refers to its loveliness: *pulchellus* (Lat: beautiful [diminutive form]).



Habitat: Open woodlands and forests; nests in rotten wood and soil underneath rocks.
Geographic range: Massachusetts and New York; south to Florida; west from Wisconsin to Louisiana.
Natural history: This species feeds predominantly on springtails (Collembola).
Look-alikes: *Pyramica metazytes;* size and shape of erect hairs and position of hairs on the clypeal margin distinguish them.





Distinguishing features:

A. Mandibles have teeth along their entire inner margins (cf. *P. pergandei*).
B. The first 1–2 pairs of clypeal hairs curve outward (cf. *P. metazytes*).
C. The erect dorsal hairs are whiplike.

Solenopsis Westwood, 1840

The Channel-faced Ants

From the Greek *solen*, meaning channel, canal, or tube, + *opsis*, meaning of the face and referring to the longitudinal groove running down the middle of the head

Solenopsis is a diverse and often reviled genus; although there are nearly 300 recognized species distributed around the world, the well-known South American Fire Ant, *Solenopsis invicta*, gives all ants in this genus a bad name. The approximately 40 North American species of *Solenopsis* are divided into three groups, but only one, the *Diplorhoptrum* group, is represented in New England, by two species. The other two groups—the *geminata* group of fire ants, which includes *S. invicta*, and the *Euophthalma* group—are primarily tropical and subtropical. The entire genus is easily distinguished by its lack of propodeal spines and by its 10-segmented antennae that end in 2-segmented clubs.

Identifying the Species of *Solenopsis*

The tiny (under 2 mm) members of the *Diplorhoptrum* group, affectionately called "diplos" (and less flatteringly called Thief Ants), all look very similar; the entire group is in desperate need of taxonomic attention and systematic revision. Although we have only two species in New England—*S. molesta* and *S.* cf. *texana*—they are no easier to distinguish now than they were in 1950, when Creighton wrote that there is so "much confusion in the case of the *molesta-texana* complex . . . that no adequate solution seems possible." *Solenopsis molesta* appears to be our most common *Solenopsis*. It is most readily distinguished from *S.* cf. *texana* by its habitat: *S. molesta* is never observed nesting in pure sand, whereas *S.* cf. *texana* nests only in pure sand. If you see them in the field, *S.* cf. *texana* is a pure lemon yellow, whereas *S. molesta* tends to be browner, on the reddish end of yellow. These colors fade in specimens that are pinned or stored in alcohol, and morphological differences between the two are subtle at best. In workers, the petiole viewed in profile is narrower in *S. molesta* than it is in *S.* cf. *texana*. In dorsal view, the postpetiole of *S. molesta* is much wider than the petiole, but the petiole and postpetiole are of similar width in *S.* cf. *texana*. The differences between the two species are more pronounced in the queens.

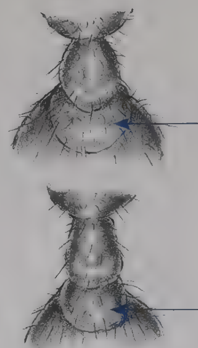
Although not illustrated here, the South American Fire Ant, *S. invicta*, has been reported once from Connecticut. The very informative collection label notes that it was found in the soil of a potted plant, a *Ficus benjamina*

(the common Weeping Fig tree that grows in shopping malls and pizza shops) that was purchased at a Stop & Shop market in Cheshire, Connecticut, on September 1, 1987. The label also notes that the plant (and presumably the colony of *S. invicta*) was shipped to Connecticut from the Republic Nursery of Wauchula, Florida. Because potted plants and bark mulch for landscaping are regularly shipped from the southeastern United States to New England, *S. invicta* will probably show up again here. But until climatic change eliminates our winters entirely, *S. invicta* will probably not survive here. In the meantime, you can distinguish *S. invicta* from our two native *Solenopsis* species by the presence of a single long hair (seta) projecting from a triangular, toothlike structure in the center of the lower (anterior) margin of its clypeus.

Key to the Species of *Solenopsis*

1a. **In dorsal view, the postpetiole is noticeably wider than the petiole; in profile view, the summit of the petiole is relatively narrow**; the ant is yellow-brown and nests in a wide variety of soils but never in pure sand .... *S. molesta*, p. 314

1b. **In dorsal view, the postpetiole is approximately as wide as the petiole; in profile view, the summit of the petiole is relatively broad**; this is a lemon-yellow ant that nests only in pure sand .... *S.* cf. *texana*, p. 319



Wide postpetiole of *Solenopsis molesta* (top) versus narrow postpetiole of *Solenopsis* cf. *texana* (bottom)

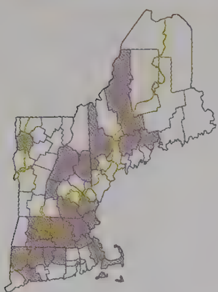
Easily Confused Species

Both *Solenopsis* and *Monomorium* lack propodeal spines, but these genera can be distinguished by their two- or three-segmented antennal clubs: *Solenopsis* has a two-segmented club, whereas *Monomorium* has a three-segmented club.

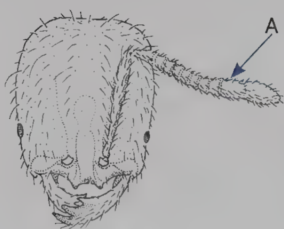
Solenopsis molesta (Say, 1836)

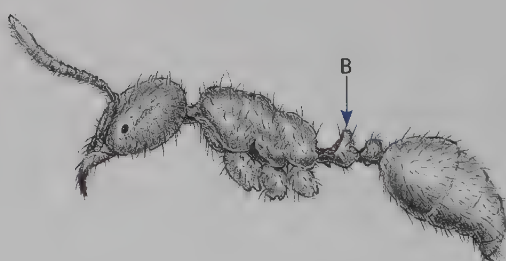
*The Thief Ant

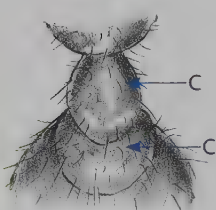
Refers to its association with other ants: *molestus* (Lat: annoying, troublesome).



Habitat: Usually nests with or near other ants in open woods and fields, houses and other buildings.
Geographic range: Throughout North America
Natural history: Like other thief ants, *S. molesta* often nests with a wide variety of other ant species, from which it steals food and perhap brood. But *S. molesta* also can be found living independently, with no apparent association with other ants. Colonies of *S. molesta* can be large and diffuse and have multiple queens. Queens and workers of *S. molesta* are both reddish to brownish yellow in color, but males are black. In its original description, Say wrote that the sting of this omnivorous ant "is like the puncture of a very fine needle."
Look-alikes: *Solenopsis* cf. *texana;* petiolar and postpetiolar size and shape, habitat, and color distinguish them.



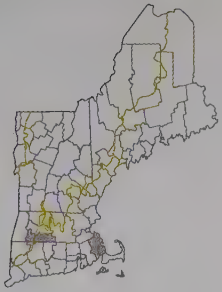




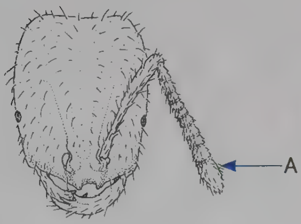
Distinguishing features:
A. Antennae 10 segmented with 2-segmented clubs (cf. *Monomorium*)
B. Petiole with a narrow profile (cf. *S.* cf. *texana*)
C. Postpetiole noticeably wider than petiole (cf. *S.* cf. *texana*)

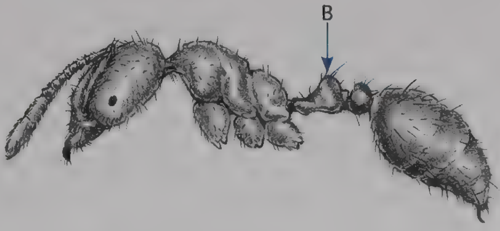
Solenopsis

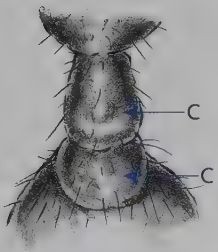
An undescribed species of *Solenopsis* that is closely related to *Solenopsis texana*



Habitat: Pure sand in pine barrens.
Geographic range: Unknown. Recorded from Nantucket Island, Martha's Vineyard, and south central Massachusetts. A fuller assessment of its range awaits a revision of the *Diplorhoptrum* group.
Natural history: Like other thief ants, *S.* cf. *texana* often nests with or near a wide variety of other ant species, from which it steals food and perhaps brood.
Look-alikes: *Solenopsis molesta;* petiolar and postpetiolar size and shape, habitat, and color distinguish them.







Distinguishing features:
A. Antennae 10 segmented with 2-segmented clubs (cf. *Monomorium*)
B. Petiole with a broad profile (cf. *S. molesta*)
C. Postpetiole and petiole ± equal in width (cf. *S.* cf. *texana*)

Stenamma Westwood, 1839

The Slender Ants

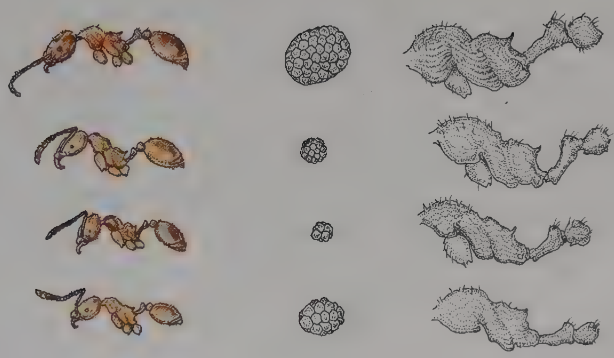
From the Greek *stenos*, meaning close or narrow and possibly referring to the posterior margin of the clypeus, which extends upward between the two frontal lobes; it could also refer to the narrow, pedunculate petiole or to the overall slender appearance of the ants in this genus

Stenamma is a genus of small, litter-dwelling ants that are uncommonly collected. In its current conception, it includes 45 species, roughly evenly split among the Nearctic and Palearctic regions and Central America. The actual number of species is probably much higher, because the Neotropical species are only now being studied. Of the 17 or so North American species, 4 are found in New England. All 4 species have antennae that end in four-segmented clubs; tiny eyes; and short propodeal spines.

Identifying the Species of *Stenamma*

Our four New England species of *Stenamma*—*S. brevicorne, S. diecki, S. impar,* and *S. schmitti*—are separated by differences in body size, eye size, and the number of facets (ommatidia) of the compound eye, and the sculpturing on the mesosoma, petiole, and postpetiole. *Stenamma brevicorne* is the largest of the four, reaching 4 mm in length, and has the largest (yet still quite small) eyes; they have more than 20 ommatidia and 5–12 (average = 8) ommatidia across the widest point of the eye. Its dark brown body is heavily sculptured. *Stenamma diecki* and *S. impar* are very similar in body size and eye size, but the ommatidia of *S. diecki* are smaller than those of *S. impar,* and there are fewer (4–5) ommatidia across the widest part of the eye of *S. diecki* than there are in *S. impar* (which has 5–6 ommatidia across the widest part of the eye). Geographically, *S. diecki* replaces *S. impar* at or just north of the Massachusetts border with Vermont, New Hampshire, and Maine. Finally, *S. schmitti* has the smallest compound eyes; they are barely visible and have only 3–6 (average = 4) ommatidia in total.

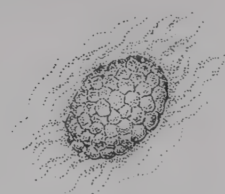
The matrix key on p. 317 illustrates six morphological characters that can be used to separate the four New England species of *Stenamma*. Each species is shown in profile; the size shown is approximately 10 times that of an average worker, and the colors illustrate differences ranging from dark to light brown. The species are ordered by size, from largest to smallest. The primary characteristics are the size of the eye and the number of



ommatidia in each compound eye. *Stenamma brevicorne* has large eyes with many facets, *S. schmitti* has tiny eyes with few facets, and the other two species are in between. Check your "eye-dentification" by looking at the mesosoma. *Stenamma brevicorne* and *S. schmitti* are heavily sculptured on all surfaces. *Stenamma diecki* has a shiny postpetiole but reasonably strong sculpturing on other surfaces of the mesosoma. *Stenamma impar* is only faintly sculptured.

ey to the Species of *Stenamma*

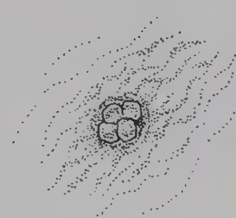
. **Compound eye with 5–12 facets (ommatidia) at its widest diameter and > 20 facets total**; this ant is relatively large for a *Stenamma* (total length 2.75–4.0 mm) .... *S. brevicorne*, p. 319



Large eye with more than 20 ommatidia of *S. brevicorne*

. **Compound eye with 3–6 facets at its widest diameter and < 15 facets total**; these are smaller species (total length 2–3.5 mm).. 2

2a (1b). **Compound eye very small, consisting of 3–6 facets;** mesosoma sculptured, with pronounced punctures, giving the ant a matte appearance.................................. *S. schmitti*, p. 322

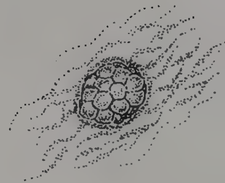


Tiny eye with up to 6 ommatidia of *S. schmitti*

2b. **Compound eye larger, consisting of 8–15 facets.** 3

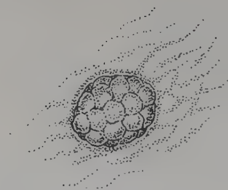
Stenamma

3a (2b). **Compound eye with 4–5 small facets across its widest diameter**; total length 2.7–3.5 mm; there is conspicuous sculpturing on the pronotum, but the promesonotum and the postpetiole are usually smooth and shiny; this ant is common north of Massachusetts .... *S. diecki*, p. 320



Medium-sized eye of *S. diecki* with four to five small ommatidia across the widest point

3b. **Compound eye with 5–6 coarse facets across its widest diameter**; total length 2.3–2.7 mm; the sculpturing on the mesosoma is faint and extends to the promesonotum and postpetiole (i.e., this ant is not smooth and shiny); it is more common in Massachusetts and southern New England .... *S. impar*, p. 321



Medium-sized eye of *S. impar* with five to six coarse ommatidia across the widest point

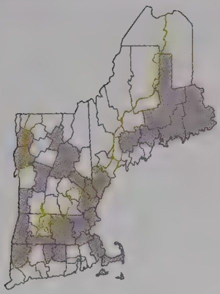
Easily Confused Species

It is possible to confuse *Stenamma* with *Temnothorax* species or *Tetramorium caespitum*, but the eyes of these two genera are much larger and have many more ommatidia than the eyes of even the largest-eyed *Stenamma*, *S. brevicorne*. Unlike any species of *Stenamma*, most species of *Temnothorax* have long propodeal spines; *Tetramorium caespitum* also has parallel, longitudinal rugae on its head and a pronounced stinger that ends in a triangular process.

Stenamma brevicorne (Mayr, 1886)

The Short-horned *Stenamma*

Refers to its antennae: *brevis* (Lat: short) + *cornu* (Lat: horn).

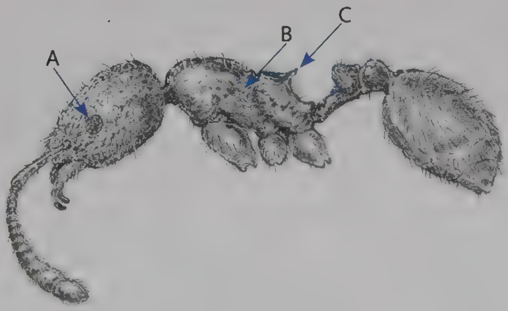


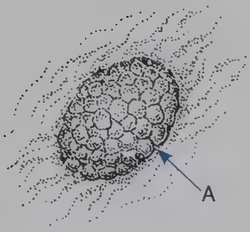
Habitat: Moist woods and forest edges; nests in soil, usually with some clay in it.

Geographic range: The Canadian Maritime Provinces; south to Virginia; west across Canada to Ontario; south to Nebraska.

Natural history: Uncommonly collected and rarely studied. Marion Smith referred to it as timid, sluggish, and carnivorous. Foragers are sometimes found in litter, under rocks, and in rotten wood.

Look-alikes: Other *Stenamma* species, *Tetramorium caespitum;* eye size and number of ommatidia distinguish the *Stenamma* species, which all lack the triangular stinger of *Tetramorium.*





Distinguishing features:

A. Compound eye with 20 ommatidia, 5–12 at widest point (cf. *Tetramorium caespitum*)

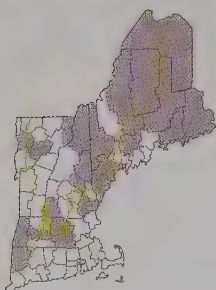
B. Body heavily sculptured

C. Propodeal spines short (cf. *Temnothorax*)

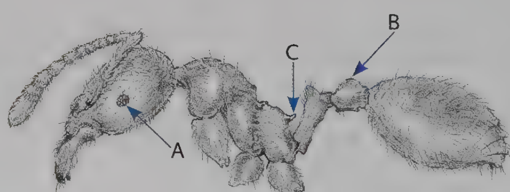
Stenamma diecki Emery, 1895

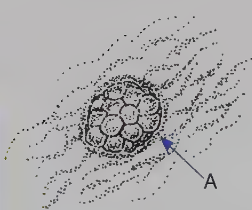
Dieck's *Stenamma*

Honors its collector, German entomologist and botanist Georg Dieck (1847–1925).



Habitat: Moist woods, forest edges, wet meadows, bogs, fens.
Geographic range: Canada and the northern United States. High elevations farther south, including the Carolinas, Iowa, California. In New England, more common north of Massachusetts.
Natural history: Rarely collected or studied. Readily preys on springtails (Collembola), and plays dead when disturbed.
Look-alikes: *Stenamma impar;* note the shiny postpetiole and relatively small ommatidia of *S. diecki.*



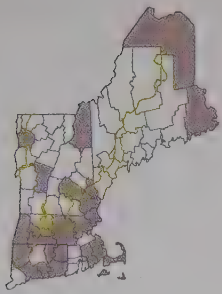


Distinguishing features:
A. Compound eye with ±15 small ommatidia, 4–5 at widest point
B. Body lightly sculptured; postpetiole shiny (cf. *S. impar*)
C. Propodeal spines short (cf. *Temnothorax*)

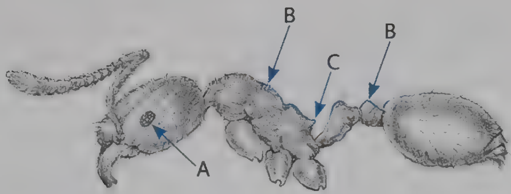
Stenamma impar Forel, 1901

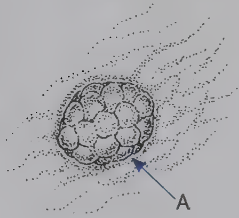
The odd *Stenamma*

Refers to its metanotum: *impar* (Lat: odd).



Habitat: Forests and woodlands; nests in dry and wet soils. In New England, strongly associated with forests dominated by oaks (*Quercus* species), especially along the coast.
Geographic range: Quebec to the Carolinas; west to the Dakotas, Missouri. In New England, most common south of Massachusetts and at low elevations in our northern states.
Natural history: Rarely collected and studied. It was distinguished as a species by Auguste-Henri Forel based on the fact that the dorsal face and posterior slope (declivity) of the metanotum (the reduced segment of the mesosoma in between the mesonotum and the propodeum) are in the same plane, but Forel followed up his description by asking, "Peut-être est-ce une espéce? Mais il faut attendre de connaître plus de matériel" (Is it even a species? We must wait for more specimens). Even today, we don't know what it eats.
Look-alikes: *Stenamma diecki;* note the light sculpturing and relatively large ommatidia of *S. impar.*



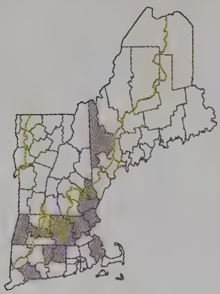


Distinguishing features:
A. Compound eye with ± 15 large ommatidia, 5–6 at widest point
B. Body, including postpetiole, lightly sculptured (cf. *S. diecki*)
C. Propodeal spines short (cf. *Temnothorax*)

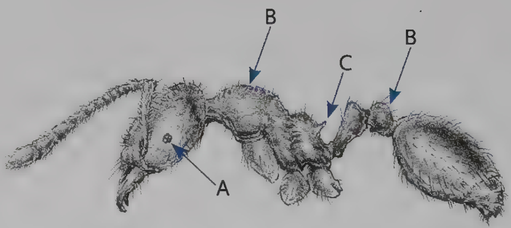
Stenamma schmitti Wheeler, 1903

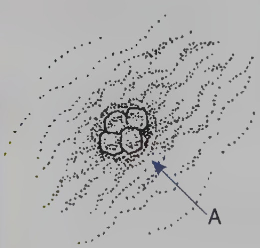
Schmitt's *Stenamma*

Honors Reverend P. Jerome Schmitt (1857–1904), its collector and the inventor of the wooden Schmitt Box, which is widely used to store insect specimens.



Habitat: Nests in litter and moist soil in forests and shrubby bogs.
Geographic range: Quebec to the Carolinas; west to Iowa, Missouri. In New England, more common in Massachusetts and farther south, but collection records are few and far between.
Natural history: Foragers may be collected in litter samples, but nests are rarely encountered. Reportedly eats springtails (Collembola).
Look-alikes: Unmistakable; the minute compound eye distinguishes *S. schmitti*.





Distinguishing features:
A. Compound eye with ± 4 ommatidia
B. Body, including postpetiole, heavily sculptured
C. Propodeal spines short (cf. *Temnothorax*)

Temnothorax Mayr, 1861

The Divided Ants

From the Greek *temno*, meaning cut or divided, + *thorax* and referring to the constriction between the ant's mesonotum and metanotum

Once considered part of *Leptothorax*, the diverse genus *Temnothorax* includes nearly 400 species, the majority of the ant tribe Leptothoracini. *Temnothorax* species live all over the world in boreal, temperate, and tropical climates. There are approximately 50 species in North America, 5 of which occur in New England. Although *Temnothorax* was named for a constriction between the second and third segments of its thorax, this constriction is rarely apparent. Instead, *Temnothorax* can be distinguished from the other Leptothoracini (*Cardiocondyla, Formicoxenus, Harpagoxenus, Leptothorax*, and *Protomognathus*) by its distinctively pedunculate petiole, its five-toothed mandibles, and the lack of any impression or suture between the mesonotum and the metanotum.

Identifying the Species of *Temnothorax*

Three species of *Temnothorax*—*T. ambiguus, T. curvispinosus*, and *T. longispinosus*—are common in New England. *Temnothorax longispinosus* is the largest and most widespread of our *Temnothorax* species (its workers are nearly 3 mm long). It has very long propodeal spines, and its dark brown to black color is distinctive. The two yellow-orange *Temnothorax* species, *T. ambiguus* and *T. curvispinosus*, are distinctively colored and can be separated by their short and widely spaced (*T. ambiguus*) or long, curved, and narrowly spaced (*T. curvispinosus*) propodeal spines. *Temnothorax curvispinosus* also has a dark blotch or strip on its gaster that can be seen in the field using a low-power (5× or 10×) hand lens. The last two species, *T. texanus* and *T. schaumi*, are warm-climate species restricted to southern New England. *Temnothorax texanus* has an unusually wide postpetiole. *Temnothorax schaumi* has unusually short propodeal spines and nests under the bark of old oak trees.

The matrix key on p. 324 illustrates five morphological characters that can be used to separate the five New England *Temnothorax* species. Each species is shown in profile; the size shown is approximately 10 times the size of a worker, and the colors illustrate differences ranging from black to orange-yellow. The species are ordered by size, from largest to smallest. The primary character to look at on the head is the number of segments on the antenna (12 in *T. texanus*, 11 in all the other New England *Temnothorax*

Temnothorax longispinosus

Temnothorax schaumi

Temnothorax texanus

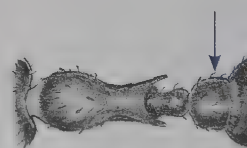
Temnothorax curvispinosus

Temnothorax ambiguus

species). Next, look at spines and the pedicel from above. The black *T. longispinosus* has long propodeal spines, whereas the dark *T. schaumi* has very short propodeal spines. The spines of *T. texanus* are intermediate in length, but unlike the other four species, it has a postpetiole that is much wider (more than 1.5 times wider) than the petiole. Finally, the two yellow-orange species have either short, widely set propodeal spines (*T. ambiguus*) or long, close-set propodeal spines (*T. curvispinosus*).

Key to the Species of *Temnothorax*

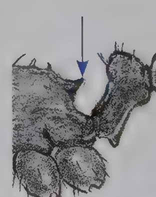
1a. **The postpetiole is massive—its width is ≥ 1.5× the width of the petiole;** this ant has antennae with 12 segments; it is roughly sculptured, with rugae on the head, mesosoma, petiole, and postpetiole; its gaster is smooth and glossy; its color is dark brown or black .... *T. texanus*, p. 330



Very wide postpetiole of *T. texanus*

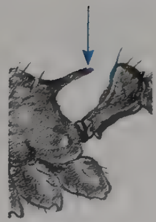
1b. **The postpetiole is < 1.25× the width of the petiole**; these ants have antennae with 11 segments; their colors are black or orange-yellow 2

2a (1b). **Head covered with fine lines** (striae); **propodeal spines short,** with their length < half the distance between their bases; the ant's color is normally dark brown .... *T. schaumi*, p. 329



Short propodeal spines of *T. schaumi*

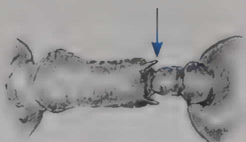
2b. **Head smooth or with netlike (reticulate) sculpturing but not finely striated**; propodeal spines longer than half the distance between their bases; these ants are yellowish orange to dark brown or black 3



Very long propodeal spines of *T. longispinosus*

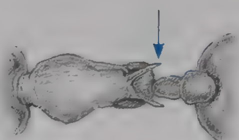
3a (2b). **A dark brown to black ant**; top of head smooth, shining; propodeal spines very long, pointing nearly straight back .... *T. longispinosus*, p. 328

3b. **A yellowish brown ant**; top of head sculptured 4



Widely spaced, straight propodeal spines of *T. ambiguus*

4a (3b). **Propodeal spines well separated at base**; spines shorter than the distance separating their bases; gaster uniform in color; postpetiole notably broader than long .... *T. ambiguus*, p. 326



Tightly spaced, curvy propodeal spines of *T. curvispinosus*

4b. **Propodeal spines close together at base**; spines much longer than the distance separating their bases; gaster with a dark splotch or stripe; postpetiole nearly square (subquadrate), i.e., not significantly broader than long .... *T. curvispinosus*, p. 327

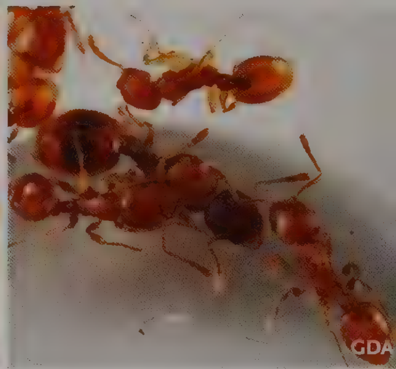
Easily Confused Species

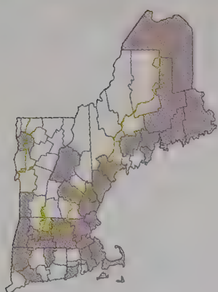
It is easy to confuse *Temnothorax* with *Cardiocondyla* and *Leptothorax*. In New England, all *Temnothorax* (except for *T. texanus*) and *Leptothorax* have 11-segmented antennae, whereas *T. texanus* and *Cardiocondyla* have 12-segmented antennae. *Temnothorax* and *Leptothorax* can be distinguished by their mandibles and the shapes of their petioles. *Temnothorax* has only five teeth on its mandibles and a petiole with a pronounced elongate peduncle, whereas *Leptothorax* generally has six teeth on its mandibles and a petiole without an obviously lengthened peduncle. Although both *Temnothorax* and *Cardiocondyla* have pedunculate petioles, *Temnothorax* has many erect hairs on its body, whereas *Cardiocondyla* does not.

Temnothorax ambiguus (Emery, 1895)

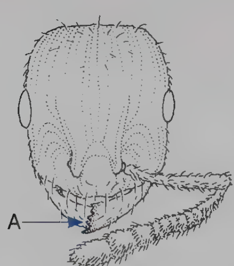
The Doubtful *Temnothorax*

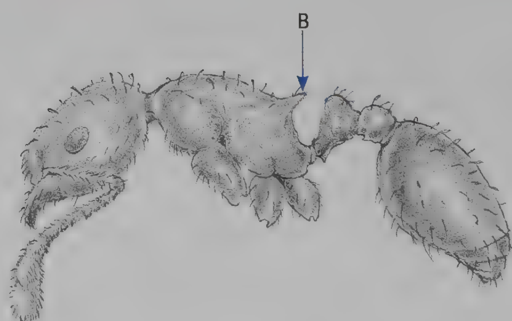
Refers to its superficial similarity to *Temnothorax curvispinosus*: *ambiguus* (Lat: doubtful, uncertain).

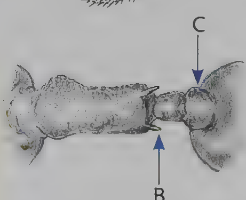




Habitat: Nests in soil, dead stems, small cavities such as hollow nuts. In New England, most common in acorns in open oak woodlands; in the Midwest, a prairie species nesting in grasslands and fields.
Geographic range: Quebec south to Virginia; west to Iowa.
Natural history: Feeds on honeydew, plant nectar, tiny insects. Enslaved by *Protomognathus americanus*.
Look-alikes: *Cardiocondyla, Formicoxenus, Harpagoxenus, Leptothorax, Protomognathus, Temnothorax curvispinosus; Temnothorax* is distinguished by its 5 mandibular teeth. Propodeal spines, postpetiole, and color of gaster distinguish the *Temnothorax* species.







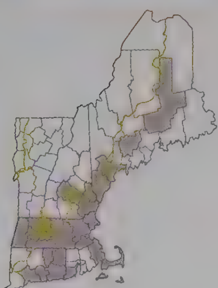
Distinguishing features:
A. Mandibles with five teeth (cf. *Leptothorax* species)
B. Length of propodeal spines < the distance between their bases (cf. *T. curvispinosus*)
C. Postpetiole wider than long (cf. *T. curvispinosus*)

Temnothorax

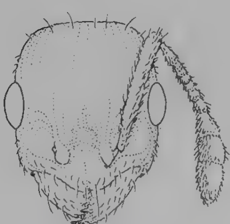
Temnothorax curvispinosus (Mayr, 1866)

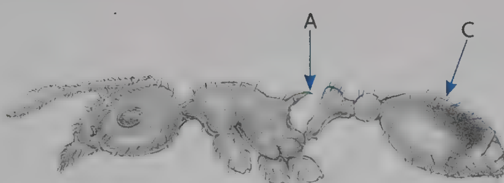
The Bent-spined *Temnothorax*

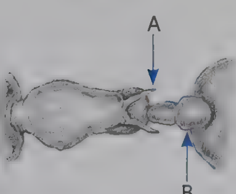
Refers to its propodeal spines: *curvus* (Lat: bent) + *spina* (Lat: spine, thorn).



Habitat: Dry woodlands; nests in acorns, under bark.
Geographic range: North America south and west to Texas. In northern Maine, it is replaced by *T. ambiguus*.
Natural history: Feeds on honeydew and plant nectar. Enslaved by *Protomognathus americanus*.
Look-alikes: *Cardiocondyla, Formicoxenus, Harpagoxenus, Leptothorax, Protomognathus, Temnothorax ambiguus; Temnothorax* is distinguished by its 5 mandibular teeth. Propodeal spines, postpetiole, and color of the gaster distinguish the *Temnothorax* species.







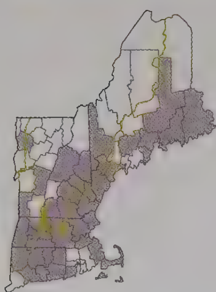
Distinguishing features:

A. Length of propodeal spines > the distance between their bases (cf. *T. ambiguus*)
B. Postpetiole about as wide as long (cf. *T. ambiguus*)
C. Dark stripe or splotch on gaster (most apparent in live ants)

Temnothorax longispinosus (Roger, 1863)

The Long-spined *Temnothorax*

Refers to its propodeal spines: *longus* (Lat: long) + *spina* (Lat: spine, thorn).

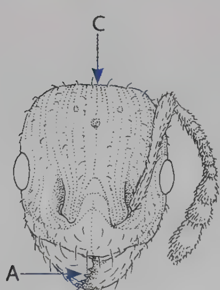


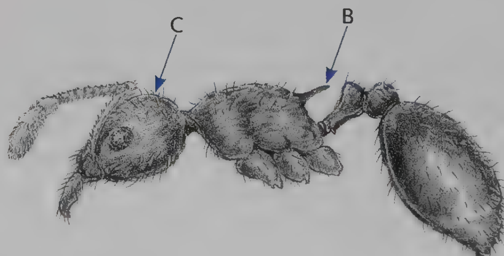
Habitat: Forests; nests in acorns, under rocks, under bark of living trees.

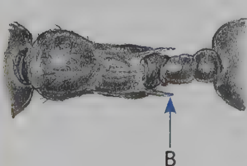
Geographic range: Throughout North America east of the Mississippi River.

Natural history: Feeds on honeydew, plant nectar, tiny insects. Enslaved by *Protomognathus americanus*. Although abundant in hardwood forests, it is the only *Temnothorax* species we find in hemlock forests. Look for it under the rocks of New England's thousands of kilometers of stone walls.

Look-alikes: Unmistakable; the black, long-spined *T. longispinosus* is unlikely to be confused with any other species in New England.







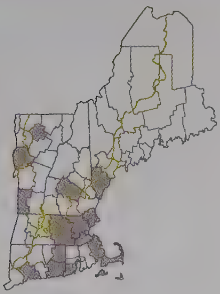
Distinguishing features:

A. Mandibles with 5 teeth (cf. *Leptothorax*)
B. Propodeal spines long and pointing straight back (cf. *T. schaumi*)
C. Top of head smooth and shiny

Temnothorax schaumi (Roger, 1863)

Schaum's *Temnothorax*

Honors its collector, German entomologist Hermann Rudolph Schaum (1819–1865).

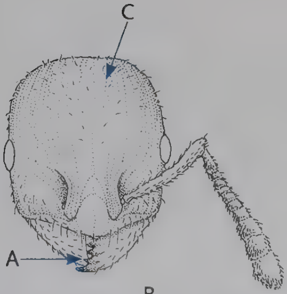


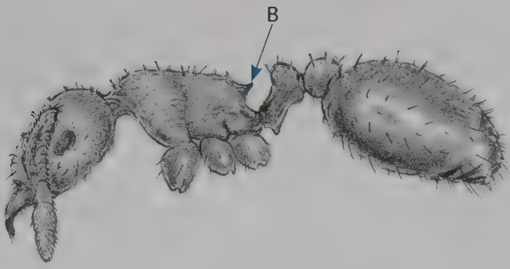
Habitat: Nests under bark of large oak trees (*Quercus* species) and Pitch Pine (*Pinus rigida*).

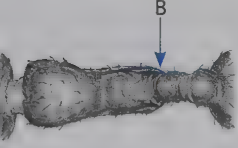
Geographic range: Maine to Florida; west to the upper Midwestern states; south to Texas.

Natural history: Very little is known of the behavior or diet of this species, which is one of the few arboreal ant species in New England. Workers forage on dead branches of otherwise live trees, on standing dead snags, and especially on the trunks of white oaks. Most commonly collected in warmer regions of New England.

Look-alikes: *Stenamma*, other *Temnothorax* species, *Tetramorium caespitum;* large eyes eliminate *Stenamma*, fine sculpturing eliminates *Tetramorium*, and short propodeal spines and striations on the head eliminate the other New England *Temnothorax* species.







Distinguishing features:

A. Mandibles with 5 teeth (cf. *Leptothorax*)

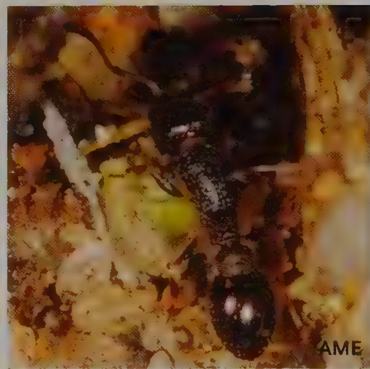
B. Short, widely spaced propodeal spines (cf. *T. longispinosus*)

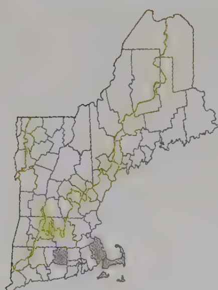
C. Very finely striated head (cf. other New England *Temnothorax*) and eyes large (cf. *Stenamma*)

Temnothorax texanus (Roger, 1863)

The Texas *Temnothorax*

Named for its type locality, Milano, Texas.



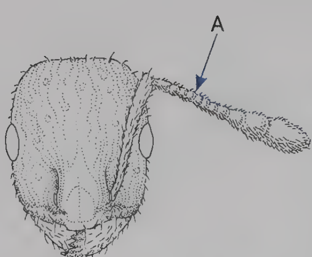


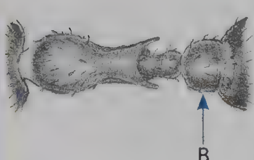
Habitat: Sandy soils and sand dunes in pine barrens.

Geographic range: Southern New England, Mid-Atlantic, Midwestern states from Michigan south to Texas. In New England, collected so far only from oak-pine woodlands in Massachusetts and northeastern Connecticut.

Natural history: In New England, a species of pine barrens and sand dunes. Makes cryptic, tiny, shallow nests with a single queen in the pure-sand soils of open, sparsely vegetated areas. Most active at dawn and dusk or on cool, cloudy days.

Look-alikes: *Cardiocondyla, Formicoxenus, Harpagoxenus, Leptothorax, Protomognathus,* other *Temnothorax* species; 12-segmented antennae distinguish *T. texanus* from all of these except *Cardiocondyla*. Postpetiolar width eliminates the latter.





Distinguishing features:

A. Antennae with 12 segments (cf. other New England *Temnothorax*)

B. Postpetiole width > 1.5× petiole width (cf. other New England *Temnothorax*)

Tetramorium Mayr, 1855

The Four-segmented Ants

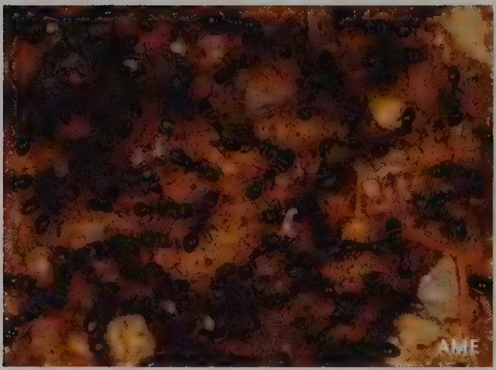
From the Greek *tetra*, meaning four, + *morion*, referring to a member or segment, here specifically to the maxillary palp

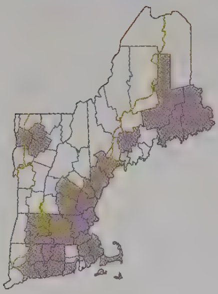
Tetramorium is a diverse genus of ants that is found throughout the world. Although there are 10 North American species, only 1, the non-native (European) Pavement Ant, *Tetramorium caespitum*, occurs in New England. *Tetramorium* was named for the number of segments (four) on its maxillary palp, but it is most easily recognized by its antennal sockets, which are deep and round. *Tetramorium caespitum* also is unique among our regional species in having a stinger that ends in a wide triangle (visible at 50× magnification). In ongoing revisionary systematics work, Birgit Schlick-Steiner and others suggest that what we now call *T. caespitum* may turn out to be a complex of as many as seven species (they refer to the North American species as *Tetramorium* species E); only time will tell!

Tetramorium caespitum (Linnaeus, 1758)

*The Pavement Ant

Refers to its native habitat: *caespita* (Lat: turf, sod).



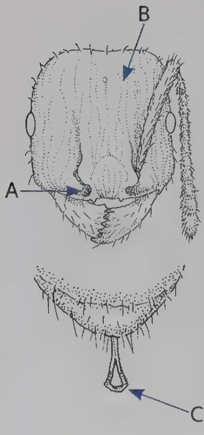


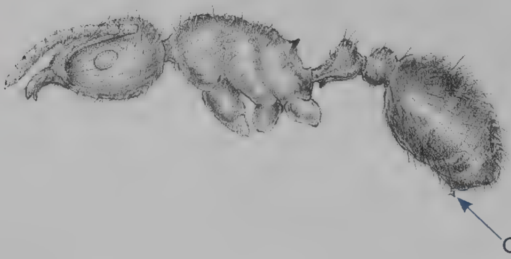
Habitat: Nests in cracks in driveways and roads, under rocks in open woodlands and disturbed areas, on sandy beaches.

Geographic range: Native to Europe. Now in eastern North America, much of New England, Montreal, southern Ontario; not yet well established in the northern Canadian Maritime Provinces.

Natural history: Makes crater-shaped nests in asphalt and sidewalks, but also nests on dirt roads, under rocks, at the base of American Beachgrass (*Ammophila breviligulata*), at the landward edges of salt marshes. Monogynous colonies large (>10,000 workers). Nearby, unrelated colonies of *T. caespitum* will fight conspicuous but non-destructive territorial battles in spring and early summer. Mating flights usually occur in June. *Tetramorium caespitum* is the host specie for the rarely collected inquiline social parasite *Anergates atratulus*, which also is native to Europe.

Look-alikes: *Stenamma brevicorne*, *Pheidole* minor workers. Large eyes eliminate *Stenamma*. Deep pits surrounding antennal insertions, parallel rugae on its head, triangular end of the stinger are all unique to *Tetramorium*.





Distinguishing features:

A. Antennae that insert into a craterlike cavity (cf. *Stenamma*, *Pheidole*

B. Head with distinctive parallel rugae (cf. *Pheidole*)

C. Triangular process at stinger end (cf. *Pheidole*)

Tetramorium

6.
The Biogeography of New England Ants

The distribution map on each species page in Chapter 5 provides a snapshot of where each species has been recorded in New England. Where do these maps come from, how accurate are they, and what can they tell us about how New England's ant fauna will respond to changes in regional climate during the next 50–100 years? These questions are in the domain of biogeography—the study of the patterns of diversity of organisms in space and time. It is well beyond the scope of this field guide to present a detailed biogeographic analysis of all the data on the distribution and abundance of ants in New England. However, in this closing chapter, we introduce you to how ecologists think about biogeographic data, illustrate some important patterns in the distribution of New England ants, and show how your own data and collecting can contribute to a better understanding of the diversity of ants in New England.

Where Do Biogeographic Data Come From?

Preserved biological specimens—along with their associated collection information—are stored in natural history collections, museum repositories, and private collections around the world. For most species they represent the only quantitative and verifiable data on where and when a particular species was found on the planet. To prepare the species distribution maps for this guide, we scoured collections in museums throughout New England and found additional specimens at Cornell University, Pennsylvania State University, and the Academy of Natural Sciences in Philadelphia. We and our colleagues have also amassed our own collections from a number of ecological field surveys. Collection data that were recovered from the labels attached to these specimens included the journalists' "who, what, when, and where": the name of the species, where it was collected (at least the state and county and sometimes the town, latitude, and longitude), the kind of habitat from which it was collected, when it was collected, and who collected it. In total, we compiled 28,205 records of 132 species that have been collected somewhere in New England. Not every specimen was identified with all of these data; habitat information was most often lacking, and latitude and longitude were rarely recorded for specimens collected in the pre-GPS era. But each of the species described in this book is based on an actual specimen or group of individuals, collected from the same nest or pitfall trap, that had been pinned or was well preserved in alcohol *and* included information on at least the state and county in which it was collected. More than

96% of the specimens also included dates of collection. We also checked and rechecked the species identifications and updated the labels to reflect current taxonomic revisions and accepted species names. The full database is stored in the Harvard Forest Data Archive (http://tinyurl.com/antsNE) and is also accessible through this book's Web site (http://NEants.net). If you have properly preserved your ants, neatly pinned them, and included a full label with all the necessary collection details (see Chapter 3), your records can contribute to this unique and growing database.

Ant Collecting in New England

All these museum specimens and the database we put together provide a window on the history of myrmecology in New England. The oldest specimen in our database with a known date is a Winter Ant, *Prenolepis imparis,* collected in New Haven, Connecticut, on April 18, 1868, by Addison Emery Verrill. Verrill was a student of Harvard's famous professor Louis Agassiz and spent 43 years (1864–1907) teaching and doing research at Yale University, where he was the first professor of zoology. Although perhaps better known as the world's authority (at the time) on squids and other marine invertebrates, Verrill did teach entomology for a few years at the University of Wisconsin. Five other specimens in our database are a few years older but do not have exact dates. These other species—*Camponotus herculeanus, C. pennsylvanicus, Lasius umbratus* (2 specimens), and *Myrmica americana*—were collected sometime during 1864 and 1865 by Verrill's brother-in-law, Sidney Irving Smith, near his home in Norway, Maine. A noted nineteenth-century entomologist and zoologist, Smith was the state entomologist of Maine and Connecticut before becoming a professor at Yale.

Our most recent specimens are from several nests of *Temnothorax texanus* that we collected at Wellfleet Bay Wildlife Sanctuary on Cape Cod, Massachusetts, on September 11, 2011, and *Cardiocondyla obscurior* that we collected on November 9, 2011, in a greenhouse at the University of Massachusetts in Boston. In the intervening 150 years, specimens were collected by dozens of others, including amateur and professional entomologists and myrmecologists (including Henry Viereck, William Morton Wheeler, William Creighton, Merle Wing, Bill Brown, E. O. Wilson, Charles Remington, and André Francoeur, among many others); undergraduate students and their professors; and renters and homeowners with *Camponotus* in their walls or *Lasius* in their drains. Both ant collecting in New England and our knowledge of the regional ant fauna have clearly accelerated in recent years: more than 70% of the specimen records in the database date from the 1980s or later (Figure 6.1), and the two undescribed species of *Lasius, L.* cf. *umbratus* and *L.* cf. *niger,* were first collected in 1985 and 2011, respectively.

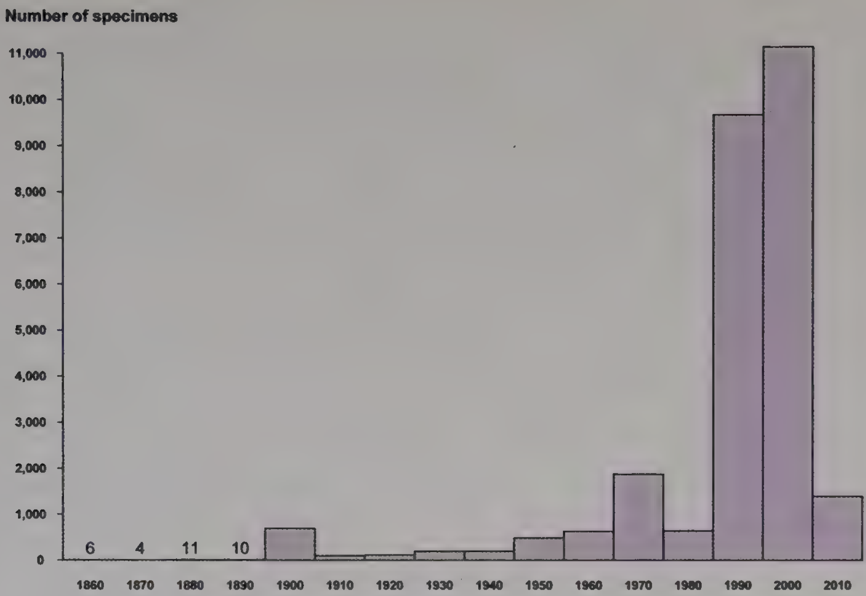


Figure 6.1. The number of ant specimens collected in New England since the 1860s. The data are grouped by decade; numbers are shown for the 1860s through the 1890s because the bars are too small to be visible on this graph.

What Is Common, and What Is Rare?

The first step in describing biogeographic patterns is to rank the 132 New England species from the most common (rank = 1) to the least common (rank = 132). The result can be illustrated with a rank abundance graph (Figure 6.2), with the species rank on the horizontal axis (the *x*-axis) and the number of records on the vertical axis (the *y*-axis). Each narrow line represents the number of records for a particular species in the database.

This rank abundance graph looks like a smooth, concave curve, with a handful of common species on the left and a much larger number of uncommon species on the right. The diversity of most other kinds of animals and plants when plotted this way will look very similar—there will be a few common species and a long right-hand "tail" of increasingly rare species. The difference in the relative abundance of the common and rare ant species is striking. At the common end, the 6 most frequently encountered species in the data set were *Aphaenogaster rudis* (2,260 records), *Tapinoma sessile* (1,903 records), *Lasius alienus* (1,629 records), *Camponotus pennsylvanicus* (1,357 records), *Myrmica detritinodis* (1,188 records), and *Myrmica lobifrons* (1,174 records). Together, these 6 species, which represent less than 5% of the 132 ant species so far recorded from New England, account for just over one-third of the collected specimens! In contrast, the 40 least commonly collected species—those with 10 or fewer records and only 118 records

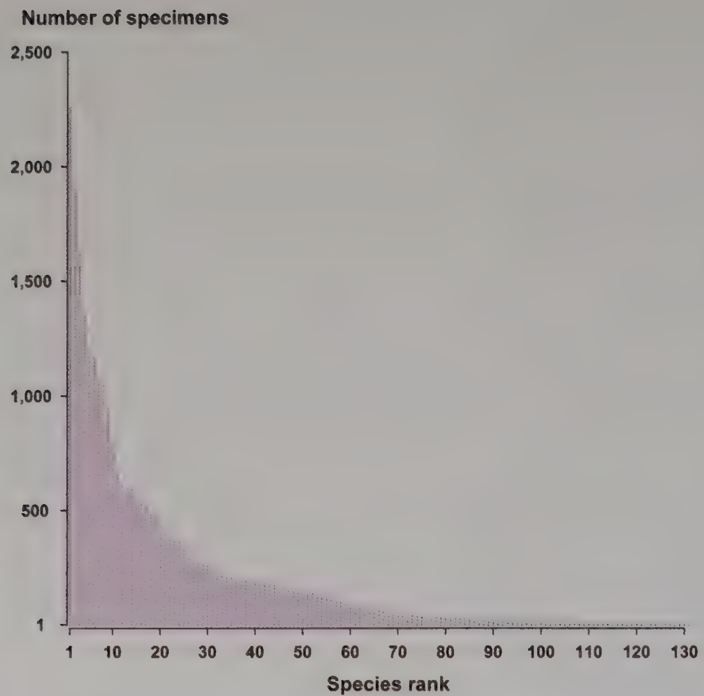


Figure 6.2. The relative abundance of New England's ant species. The *y*-axis is the number of specimens of each of the 132 species so far collected in New England; the species are ordered left to right from the most common to the rarest.

total (only 0.5% of all the collection records)—account for nearly one-third (30%) of the species diversity! And in the far right-hand tail of Figure 6.2, representing the rarest of the rare, are 17 species each represented by only a single record (singletons): *Aphaenogaster mariae, Cardiocondyla obscurior, Formica dirksi, F. hewitti, F. morsei, F. reflexa, Lasius* cf. *niger, Monomorium floricola,* the undescribed *Myrmecina* species, *Myrmica* sp. AF-eva, *Myrmica* sp. AF-ine, *Paratrechina longicornis, Pheidole flavens, Proceratium pergandei, Pyramica pulchella, Solenopsis invicta,* and *Tapinoma melanocephalum.*

The Reasons for Rarity

Why are so many of these New England ant species so uncommon? A number of mechanisms are possible, and often more than one of these explanations will apply to any particular case of rarity.

Taxonomic Rarity

Some species may be rare because they have been described only recently and therefore were not recognized by previous researchers. In our list of 17

singletons, *Lasius* cf. *niger,* the undescribed species of *Myrmecina,* and *Myrmica* sp. AF-eva fall into this category. These species will probably turn out to be more common once we sort through previously identified material and separate them from closely related species in the same genus. At the same time, it is important to note that taxonomic issues can also affect common species. The most common species on our list, *Aphaenogaster rudis,* is, in reality, a species complex or group of closely related species. Genetic and morphological studies are currently under way to clear up the taxonomy and phylogeny of this important New England ant genus. Like a phone company monopoly, this large complex will eventually be broken up into a set of species, each of which is less common than we now think. However, except for the height of the very first bar in Figure 6.2, this kind of change will not affect the shape of the rank abundance graph very much.

The most challenging cases of taxonomic rarity are those in which a species has been recorded only once, from a single specimen or a single nest. *Formica dirksi, F. morsei,* and *Myrmica* sp. AF-ine fall into this category. The specimen base for these species consists of a single queen of *F. dirksi* collected in 1946, a group of workers of *F. morsei* collected from a single nest in the early 1900s, and a single queen of *Myrmica* sp. AF-ine collected in 2006. None of these species has been collected again. Without multiple specimens, it is hard to be confident that these specimens actually represent new species rather than variants of existing species. However, in all three of these cases the ant's morphology is so clearly different from that of any known species that identifying them as distinct species seems reasonable.

Sampling Rarity

Some species may appear to be rare because the traditional sampling methods do not pick them up very well. *Proceratium pergandei* and *Pyramica pulchella* are small-bodied, specialized predators that feed on spider eggs and springtails, respectively, and nest mostly in soil and under rotting logs. The New England species of *Solenopsis* and *Stenamma* are tiny (our native *Solenopsis* species are under 2 mm in total body length, and *Stenamma* is not much larger) and timid. All of these species have small colonies (under 100 workers) and do not forage far from their nests, so they tend not to be collected in pitfall traps, bait samples, or hand collections. Similarly, *Aphaenogaster mariae, Camponotus caryae,* and *Temnothorax schaumi* are arboreal species that nest high up in the canopy and rarely forage on the ground. Like *Proceratium* and *Pyramica* in the litter, these canopy dwellers will rarely, if ever, be collected in pitfall traps; look for them in stacks of cut firewood, and maybe you will find them! Some myrmecologists have developed specialized collecting bags (Winkler sacks; see Chapter 3) for separating cryptic

ants from leaf litter samples; others climb trees or use insecticide fogs to sample ants from the canopy. In tropical rainforests, these methods have uncovered large, specialized groups of ant species in these habitats. Here in New England, we don't have very many species that are canopy or leaf litter specialists, but undersampling of particular hard-to-see and hard-to-reach habitats is still an important issue in ant surveys.

Geographic Rarity

In theory, the three unique species that have been recorded only from New England (*Formica dirksi, F. morsei,* and *Myrmica* sp. AF-ine) are *endemics:* species whose entire geographic ranges are restricted to one region. But it is more likely that these species have wider distributions, perhaps belong to other described species, or possibly were once abundant but have become rare or even gone locally extinct as the New England landscape has changed. In point of fact, the remaining 129 species known from New England all have geographic ranges that extend beyond the boundaries of New England: our ecoregions (see Chapter 1) cross state lines and extend well beyond New England; New England itself does not form a natural biogeographic unit for ants.

Some species that are rare in New England but are more common elsewhere reach the edge of their geographic ranges here. For example, boreal species such as *Formica hewitti* and *F. podzolica* (with only one and six New England records, respectively) become much more abundant farther north, in central Quebec. Some of the other boreal species that we described in Chapter 5 (*Leptothorax retractus, L. sphagnicolus, Myrmica lampra, M. quebecensis,* and *M.* sp. AF-sub) have not yet been collected in New England; look for them on high mountaintops in New Hampshire and Vermont and in the boreal forests of northern Maine.

On the other hand, the carpenter ants *Camponotus castaneus* and *C. chromaiodes* and the small Myrmicinae *Temnothorax texanus* are widespread throughout the southeastern United States, but in New England they normally don't nest north of southern Massachusetts. However, there are always exceptions to these rules. For example, our database includes a record of a single *C. chromaiodes* specimen that was collected in Burlington, Vermont, on September 14, 1983, and the specimen is clearly labeled "Burlington, VT," so we know it was not collected in Massachusetts or North Carolina. The large geographic separation between the 151 other records of this species and the single northern Vermont record might reflect poor sampling in intervening areas, which is always a possibility for New England ants. Or it may represent a true break (or *disjunction*) in the geographic range of this species. And for a southern species like *Camponotus chromaiodes,* the relatively warm microclimate of Burlington along the shores of Lake

Champlain is probably the only place in Vermont where we would expect to collect it. But as New England's climate warms, you may start to find other southern species that we described in Chapter 5, such as *Camponotus subbarbatus, Lasius murphyi, L. plumopilosus, Nylanderia flavipes,* and *Pachycondyla chinensis,* showing up here in New England.

Taking this to the extreme, we can identify certain species that favor extremely warm or extremely cold temperatures. The most clear-cut examples of such thermal specialists in New England are the tropical tramp species *Hypoponera punctatissima, Tapinoma melanocephalum, Cardiocondyla obscurior, Monomorium floricola, Monomorium pharaonis, Paratrechina longicornis,* and *Pheidole flavens,* which can survive our winters only by nesting indoors, in greenhouses or heated buildings. Although thermal tolerances can determine how far a species can range north or south, we should be cautious about reversing this logic and inferring the thermal tolerance of a species from its geographic range. For example, the Winter Ant, *Prenolepis imparis,* occurs throughout New England, and its geographic range extends from Canada to Mexico. Its workers can successfully forage at cooler temperatures than those of nearly all other species, and *P. imparis* is usually the first ant to emerge in spring and one of the latest to disappear in autumn. Yet its range does not extend into boreal regions, and it does not nest at high elevations. Clearly its distribution is limited by something other than just its thermal tolerance. Ongoing laboratory studies of the thermal tolerances of New England ant species will eventually help us understand the extent to which thermal specialization contributes to geographic ranges and habitat associations we measure in the field (or the home).

Finally, remember that maps represent only composite snapshots of distributions based on when and where the specimens were collected. Changes in habitat and land use are always occurring in New England and elsewhere, and the abundance and distribution of many species of ants (and other organisms) reflect those changes. For example, as the farm fields of colonial New England were abandoned and the forests regrew (Chapter 1), prairie species such as *Formica ulkei* and *F. reflexa* became restricted to grassland remnants in Down East Maine.

Rarity of Habitats and Resources

Some species may be rare regionally but common in certain, often uncommon, habitats that have unique environmental conditions. A good example of such a species is *Myrmica lobifrons,* which is a true bog specialist. *Myrmica* is a species-rich genus in New England, and most species in this genus are found in forests or other open habitats. But in bogs and nutrient-poor fens, *M. lobifrons* often is the most common *Myrmica* species, and it will not be found in adjacent forests.

But if *M. lobifrons* is such a habitat specialist, why is it number 6 (with 1,174 records) in our database of New England ants? The answer is that we have been focused on collecting ants from bogs throughout New England for the past 15 years. Thus the records of *Myrmica lobifrons* in our database are artificially inflated by our own collecting efforts in this unique habitat. This shows the potential hazards of nonrandom sampling and how it can influence the composition and ordering of species lists. If we were to exclude our own samples from the database, there would be only 10 records of *Myrmica lobifrons* in the database and its ranking would change from number 6 to number 93 out of 132. This lower (rarer) rank is probably a more accurate representation of its true occurrence: a randomly placed pushpin on the map of New England is unlikely to land on a bog because this habitat constitutes less than 1% of all the available land area in New England.

Of course we could remove such focused collections or specialized records from our lists, but how would we know where to start and when to stop? Many collectors save only the least common species (do you really want to pin 1,000 Eastern Carpenter Ants?), and most museum records do not include good habitat information for creating separate lists for different habitats. Although latitude, longitude, and elevation can be measured in standard units, we don't have a habitat scale or designation that everyone can agree on. One collector's "wetlands" might be another collector's "ombrotrophic bog," and sorting out the collections and notes of others can be difficult. Therefore, you should do your best to provide concise but detailed habitat labels for your ant specimens (see Chapter 3). "Mesic beech-maple forest" is better than "deciduous forest," which is better than "woods." As you collect and study ants, you will want to learn about the associated vegetation and land-use history (Chapter 1) of the landscape in which you find them.

Finally, for most ant species the underlying causes of habitat specialization are poorly known. We assume that *Myrmica lobifrons* has specialized adaptations that allow it to colonize bog habitats, where the peat mosses and soils are acidic, waterlogged, and low in oxygen. Those same adaptations might reduce the performance of *M. lobifrons* in adjacent forests. But that is just an assumption. We would have to conduct experiments in which we moved ant nests from one habitat to another, observed the ants' responses, and then determined which aspects of the species' physiology, morphology, or behavior caused the observed responses. Such experiments are challenging to design and replicate but are well worth the effort.

What about Introduced Species?

Of the 132 species recorded in New England, only 14 are considered nonnatives: *Hypoponera punctatissima, Tapinoma melanocephalum, Lasius* cf. *niger,*

Nylanderia flavipes, Paratrechina longicornis, Anergates atratulus, Cardiocondyla obscurior, Monomorium floricola, M. pharaonis, Myrmica rubra, M. scabrinodis, Pheidole flavens, Solenopsis invicta, and *Tetramorium caespitum.* In total, only about 10% of New England's ant species are non-native, and this percentage is lower than in many other parts of the world. For example, Florida has the highest incidence of non-native species in the United States: 25% of its ant species are non-native, and more arrive every year. The warm climate of Florida is certainly more inviting to tropical ants (of which there are thousands of species) than the frigid winters of New England, and indeed, seven of our non-native species are tropical tramps. Although not strictly a tropical tramp, the Southern Fire Ant, *Solenopsis invicta,* also is a tropical species, but in North America it can be found as far north as southern Virginia.

The other six of our non-native species arrived in New England from more temperate latitudes on other continents. Ants are superbly adapted for hitchhiking in soil, plants, and wood products, and it is curious that in spite of centuries of trade and human migration between North America and the rest of the world, few species of European ants or ants from the higher latitudes of Asia, South America, Africa, and Australia have colonized New England. For example, there are many species of wood ants (in the *Formica rufa* group) that are very abundant and aggressive and function as important ecosystem engineers in European forests. *Formica rufa* itself has turned up and established colonies in southern Ontario, and it may be only a matter of time before it shows up here. On the other hand, as with human migration and movements, perhaps some of the so-called native New England ant species were introduced so long ago that they were well established before scientific ant collecting began in earnest in the early 1900s.

Still, most of the non-native species are rare and probably have little ecological impact. The two exceptions are the Pavement Ant, *Tetramorium caespitum,* and the European Fire Ant, *Myrmica rubra. Tetramorium caespitum* is widespread and abundant but has yet to attract much notice. In contrast, *M. rubra* occurs throughout coastal New England and along some inland rivers, and it is considered an invasive species of management concern, especially in Maine. It is aggressive and stings picnickers, although its impacts are nothing like those of the South American Fire Ant, *Solenopsis invicta,* which has transformed the ecological landscape of the southeastern United States since its accidental introduction in the late 1930s. Watch for new ecological challenges, however, once the Asian Needle Ant, *Pachycondyla chinensis,* reaches New England's forests from farther south, where it is already established. *Pachycondyla chinensis* is not as aggressive as the South American Fire Ant, but it has a powerful sting and can displace native ant species.

How Many Species of Ants Are There in New England?

All these data—from collection records, distribution maps, and experiments determining the causes of rarity and the ongoing migration of species—contribute to answering this one fundamental question. Even with our best efforts to comb collections and query experts about the species known from our region, determining the true number of ant species in New England is like shooting at a moving target. Indeed, we found ourselves frantically adding new species descriptions and drawings at the 11th hour: *Lasius* cf. *niger* was first collected in Massachusetts only three months before this book went to press; we discovered the 1901 Connecticut record of *Aphaenogaster mariae* in Harvard's own Museum of Comparative Zoology (MCZ) two months after that; we collected *Cardiocondyla obscurior* in a greenhouse on the campus of the University of Massachusetts at Boston while the final manuscript was being reviewed and copyedited; and we discovered the 1987 *Solenopsis invicta* collected in a Connecticut flowerpot among a pile of over 2,000 unsorted vials from Yale's Peabody Museum of Natural History just before we went to page proofs! In a classic example of the challenges of labeling, the collection locality of the MCZ specimen of *A. mariae* was given simply as "Colebrook," without any corresponding country, state, or county. A careful search of the literature turned up this record in a 1906 *List of the Formicidae* (the only other checklist for New England) written by William Morton Wheeler and published by the now defunct Boston Society of Natural History. As in the case of priceless art objects, the provenance and validity of specimen records depend largely on how carefully the original collection data were recorded.

Estimating the Number of Species in New England

The data we have already collected can, however, yield some important clues about the number of species that have not yet been detected. To estimate the number of undetected species, we rely on some statistical methods that are based on the party game of guessing the number of jelly beans in a large jar. Imagine that our database of 28,205 ant records of 132 species is transformed into a giant jar of 28,205 individual jelly beans representing 132 different colors (wow!). Reach into the jar and pull out a single jelly bean, which represents one record of one species. We can plot this simple result on a graph: the x-axis is the number of records (= jelly beans) sampled, and the y-axis is the number of species (= different colors) recorded. Our first jelly bean gives us the first point on the graph, because one jelly bean represents a single, unique color; the point on the graph will be located in the lower left corner at point 1, 1 ($x = 1$, $y = 1$).

But what happens when you pick the second jelly bean? If it is a different color, the graph rises to the point 2, 2: two jelly beans (records) on the

x-axis and two colors (species) on the y-axis. On the other hand, if you draw the same color of jelly bean a second time, the curve will stay flat as the point moves to 2, 1: two jelly beans on the x-axis but still only one color (species) on the y-axis. Keep going (that's a lot of jelly beans!), and you will eventually draw all 28,205 jelly beans and record all 132 species, which is the high point of our graph. The curve that connects all the points is called a species accumulation curve and will look like a ragged staircase: it stays flat when you keep pulling out jelly beans of the same color and then rises by one step whenever you draw a new color of jelly bean (corresponding to a species that you have not sampled before). We call this graph a species accumulation curve because species accumulate on the y-axis as individuals (specimen records) accumulate on the x-axis.

Now put all the jelly beans back in the jar, mix them up, and do it again. Would you get the exact same curve? Probably not, but the new species accumulation curve would look pretty similar. And, if you repeated this sampling experiment hundreds of times and calculated the average of the number of species for each number of individuals, you would end up with a smooth curve that always started at 1, 1 and rose to the endpoint 28,205, 132.

Such a smooth, averaged species accumulation curve is shown as the solid line in Figure 6.3 (fortunately, a computer did the repeated sampling for us!). The averaged species accumulation curve has a characteristic shape: it rises relatively quickly during the early part of the sampling as lots of species (or different-colored jelly beans) accumulate. The first species recorded in the curve are usually the common ones. Once the common species are encountered, the curve continues to rise but much more slowly: it takes more intensive sampling to encounter the remaining rare species as we move from left to right in the relative abundance curve (see Figure 6.2). Eventually, the species accumulation curve flattens out because it takes more and more searching to find the rarest species. In particular, with a jar full of 28,205 jelly beans, you are likely to have to pull out an awful lot before you get the one blue jelly bean that represents, for example, *Formica hewitti*.

The species accumulation curve lets you estimate how many records you would have to sample to record a particular number of species. For example, in our data set of 28,205 records, 132 species, and the relative abundance distribution in Figure 6.2, we would need to sample only about 3,000 records to get 100 species. But, on average, it will require pulling all 28,205 records to get all 132 species. Because the order in which you sample particular species will vary from time to time (as on different tries in pulling jelly beans out of a jar), there is uncertainty as to the precise shape of the species accumulation curve. The purple funnel-shaped cloud in Figure 6.3 shows the range of possibilities for a "typical" draw.

But have we collected all of the species present in New England when we reach 132? Certainly not! Our data extend up the species accumulation curve

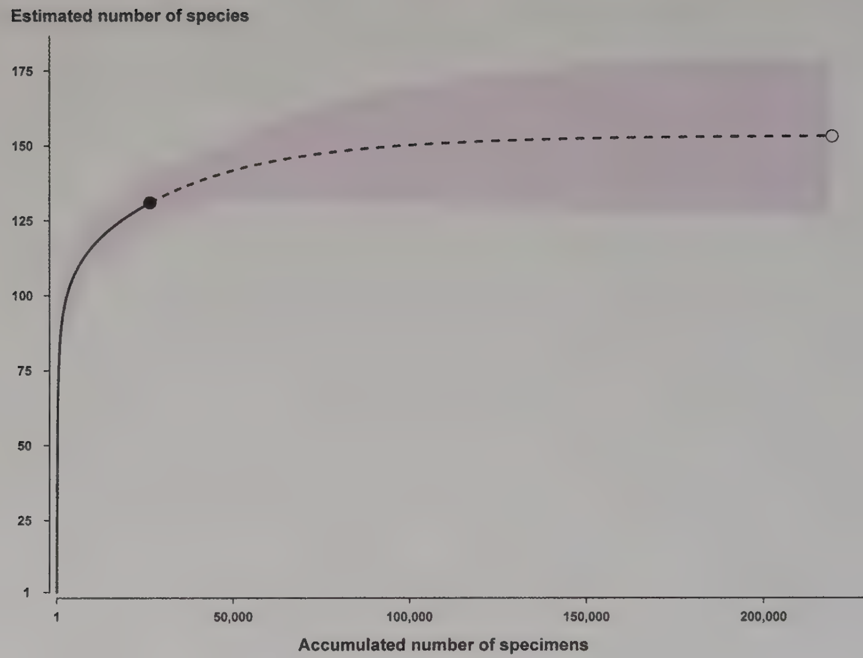


Figure 6.3. A species accumulation curve based on ant specimens collected in New England and their relative abundance. The values on the *x*-axis are the cumulative number of specimens, and the values on the *y*-axis are the estimated number of species that we would expect to find for any particular number of specimens. The solid black dot identifies our actual data (28,205 specimens and 132 species). The dotted line and the shaded region represent, respectively, the average number of species we would expect to have for a given number of specimens and the 95% confidence interval that represents the associated uncertainty in this number based on computer simulations. The open black circle identifies the expected number of species in New England, and the dotted line represents the species accumulation curve we would most likely trace to find the next 21 ant species in New England.

only to the level of our current database ($x = 28{,}205$ specimens, $y = 132$ species). Statisticians have developed methods to extend the species accumulation curve out to its hypothetical endpoint, or ceiling. Once the ceiling is reached, we would not expect to find any new species that had not been recorded earlier. The dashed part of the curve in Figure 6.3 shows this forecast: 153 species! In other words, given the data we already have, we predict that there are 21 more species of ants yet to be collected in New England; you might be the first to find one of these species-in-waiting.

For many statistical and biological reasons (including the possibility of climate and habitat change), it is best to view this forecast as an estimate of the *minimum* number of undetected species, and indeed, the 95% confidence interval of our maximum estimate extends to 179 species. But we

have some degree of confidence in this forecast, because more than half of the estimated 21 species yet to be found are likely to be species that already have been collected just outside of New England—in nearby New York, Quebec, and the Canadian Maritime Provinces—but that nest in habitats that can be found somewhere between Connecticut and Maine (Chapter 5).

Where Should You Look for Additional Ant Species in New England?

Our prediction of additional species lurking in the fields and forests of New England is encouraging—let's get out in the field and hunt! But before packing your pooter and loading your daypack, look carefully at the x-axis of Figure 6.3. We have nearly 30,000 specimens in our database, but the estimated total ant species richness of 153 ant species isn't reached until the total number of specimens is nearly 220,000! In other words, we would need to collect over seven times as many specimens as have been collected in the past 150 years to have a reasonable chance of finding those missing 21 species!

Why so much work? The answer is that, in looking for the missing species, we are now looking for the rarest of the rare—so rare, in fact, that they are currently invisible. Nevertheless, it might not be so hard to find these species. The statistical model from which we derived Figure 6.3 assumes that we continue to randomly sample ants in the same way that we have over the past 100 years. But with knowledge of which habitats and regions of New England are undersampled, you may find the missing species without quite so much sampling.

So where should you look? We've talked a lot about the number of species and how common or rare they are but a lot less about where they are and where collectors have looked for them. Just as it was informative to graph the relative abundance of species and the species accumulation curve, it is also very informative to plot out the places were species richness is high and the places where it is low. Figure 6.4 organizes all of our ant data into maps that illustrate the patterns of species richness and collection records for all 67 New England counties (for the names and locations of these counties, see Counties of New England at the back of this book).

The map on the left side of Figure 6.4 shows the number of specimen records in each county. In these plots, darker shades of purple indicate counties from which we have a large number of specimens, and lighter shades indicate counties from which we have very few specimens. Using the same color scheme, the map on the right shows the number of species recorded from each county. Although the total number of ant species recorded in New England is 132, the maximum number recorded in a single county is 83 (from Plymouth County, Massachusetts, from which we also have 1,704

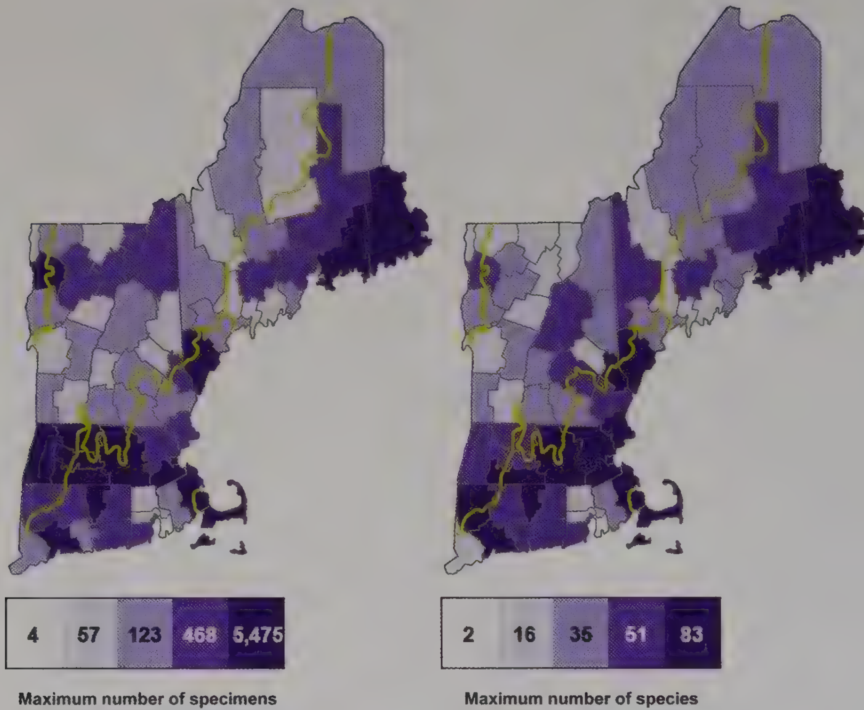


Figure 6.4. Collection history and species richness of ants across New England. In these maps the number of specimen records (left) and the number of species found (right) in each county are color coded, from white (fewest specimens or species) to dark purple (most specimens or species). The five different shades of color indicate the different quartiles of specimens or species. The yellow lines indicate ecoregional boundaries. Although ant species richness is highest on the coast and in southern New England, these maps illustrate that these areas also have the highest number of samples. Will we find more species as we look in counties that have been sampled less frequently in the past? See Figure 6.5 for statistical analysis of these data.

specimen records), and the minimum is 2 (from Newport County, Rhode Island, from which we have only 4 specimen records).

Part of the variation in species richness across New England that we observe is clearly a sampling effect—counties with more records tend to have more species. Does this mean that all we need to do is collect more samples from poorly sampled counties? No. Even if the number of ant species per square kilometer were uniform across New England, we would still expect the species counts to differ among counties for two reasons. First, some counties are larger in surface area than others and will have more ants because they are larger (an area effect). Second, some ant species nest only in very specific habitats or have very narrow climatic requirements. Different habitats are not evenly or randomly distributed among counties,

and climate varies with latitude (warmer in the south, cooler in the north), longitude (inland to the coast), and elevation. Therefore, different counties will have different numbers of species due to habitat availability and variation in climate.

The two graphs in Figure 6.5 illustrate the sampling effect (left) and the area effect (right) for New England ants. In the left graph of Figure 6.5, the *x*-axis reflects the number of specimen records and the *y*-axis reflects the number of species. Each point represents a different county, and the six different colors of the symbols indicate the general climates of the six New England states. "Cold" colors represent northern states (dark blue = Maine, blue = Vermont), and "warm" colors represent southern states (red = Connecticut, dark red = Rhode Island). The curve passing through the cloud of data points represents the trend in the data, and it can be used for estimation or forecasting.

The right graph of Figure 6.5 is organized the same way, but in it, the *x*-axis reflects the area of the county (in square kilometers) rather than the number of specimens. In both graphs of Figure 6.5, a strong sampling effect is apparent: species counts drop off sharply for those counties with fewer than 400 records. The largest number of records is from counties in the Boston area, which reflects the historical influence of Harvard's MCZ and the high concentration of myrmecologists in this part of the world. There

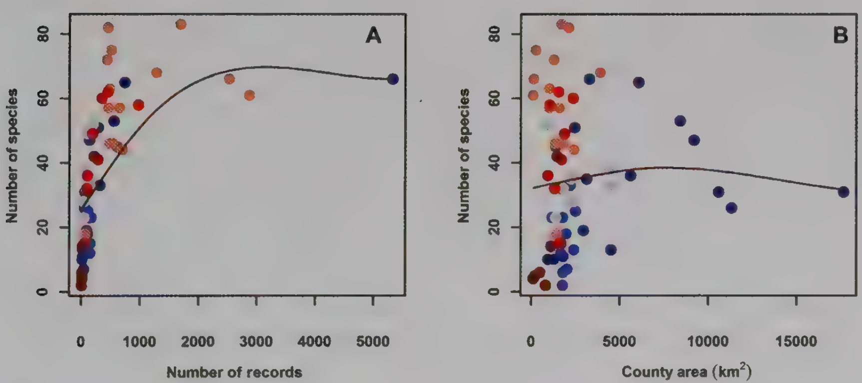


Figure 6.5. Sampling and area effects on ant species richness in New England counties. Left: the relationship between the number of specimen records and the number of species recorded; Right: the relationship between the area of the county and the number of species recorded in it. In both graphs, each point represents a different New England county, and the different states are indicated by different colors related to their average annual temperature: Maine—dark blue; Vermont—blue; New Hampshire—light purple; Massachusetts—orange; Connecticut—red; and Rhode Island—dark red. The black curve in each plot indicates the most plausible statistical relationship between the number of species recorded from each county and either the number of specimens collected in it or its area.

are also more than 2,000 ant specimen records from Nantucket County, Massachusetts, which was heavily sampled for much of the first decade of the twenty-first century, and more than 5,000 specimen records from York County in Maine, where the Waterboro Pine Barrens were intensively surveyed in 1996 and 1997. On the other hand, the effect of county area is much weaker; there are several very large counties in Maine that have few species reported. In both graphs there is considerable scatter in the data, so the difference among the counties in the number of ant species recorded most likely is due to some other factor interacting with county area, sampling effort, or a combination of the two. These differences may be related to habitat, climate, or other geographic variables.

We can explore the relationship between the number of ant species and a wide range of variables associated with each county. For example, consider latitude, longitude, elevation, and average annual temperature for each county (determined for the geographical center of the county). These variables are good indicators of variability in habitat types and local climate. In Figure 6.6, we illustrate the relationship between each of these variables and the number of ant species. As in Figure 6.5, each point represents a different county, and the six different colors of the symbols indicate the six New England states. The curves illustrate the relationships between each geographic or climatic variable and the observed number of ant species.

Once again, there is a lot of scatter in the data, but some of that can be attributed to variation in the number of sampling records. For example, in the graphs of species richness versus latitude (see Figure 6.6A) and temperature (see Figure 6.6D), there are clusters of dark red symbols below the trend line. These dark red symbols represent the counties in Rhode Island, which we hypothesize should have many more species because they are relatively southern and relatively warm compared to the other counties. But Figure 6.4 shows that very few ant specimen records are available from Rhode Island counties, and this likely reduces the number of species observed.

In spite of the scatter in all four graphs of Figure 6.6, the curves suggest where you might profitably look for more ant species. There is a strong relationship between species richness and temperature (see Figure 6.6D): there are more species where it is warmer. There is also a strong negative relationship between species richness and latitude (see Figure 6.6A): there are more species farther south than there are in the north. The average annual temperature and habitat diversity (Chapter 1) are both higher in southern New England than in northern Maine. The relationships between the number of ant species and either elevation (low to high; see Figure 6.6C) or longitude (west to east; see Figure 6.6B) are weaker but still informative. Ant species richness declines with elevation: high mountaintops are colder

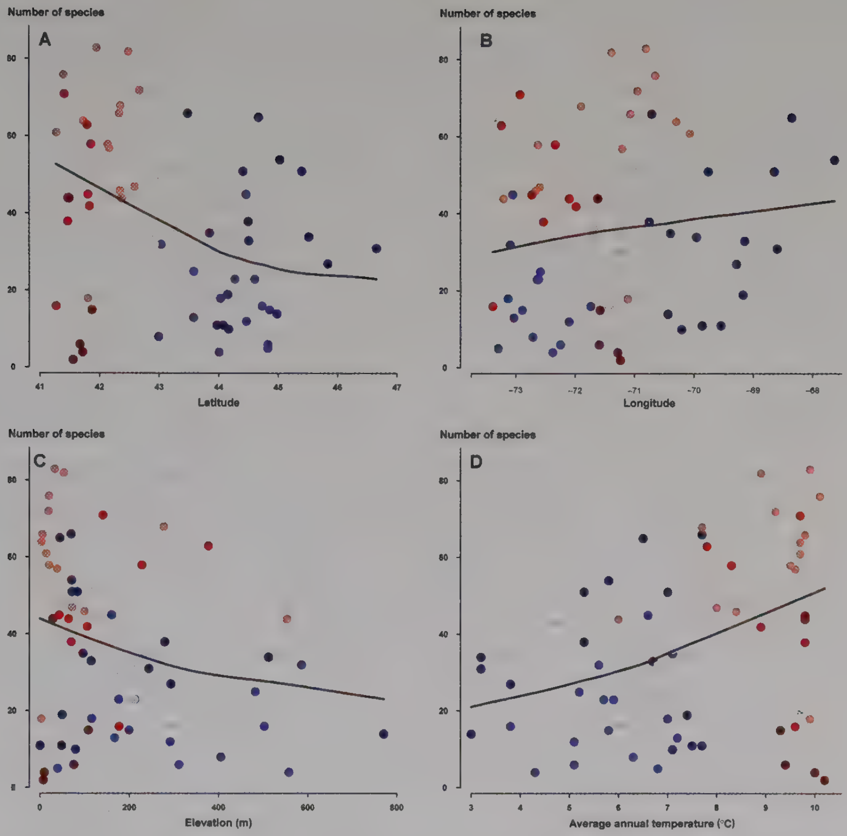


Figure 6.6. Geographic patterns of ant species richness in New England. The four graphs illustrate the relationship between species richness in each county and its latitude (A), longitude (B), elevation measured in meters above sea level (C), and average annual temperature (D). In all four of the graphs, each point represents a different New England county, and the different states are indicated by different colors related to their average annual temperature: Maine—dark blue; Vermont—blue; New Hampshire—light purple; Massachusetts—orange; Connecticut—red; and Rhode Island—dark red. The black curve in each plot represents the most plausible statistical relationship between the number of species recorded in each county and its geographic or environmental variables.

and cover less area than the valleys below. Richness increases toward the coast, which may reflect, in part, the maritime influence that moderates the climate nearer the Atlantic Ocean. Thus the best chances for finding additional species are in the southern coastal counties of Rhode Island and Connecticut. But there are also likely to be cold-climate specialists hiding in the high elevations of Vermont and Massachusetts and in the remote northern counties of Maine. Happy hunting!

Climatic Change and the Future of New England Ants

As we were finishing this chapter, Hurricane Irene swept up the east coast of the United States, first touching land on the outer banks of North Carolina on August 27, 2011. By the time it reached New England it had weakened to a tropical storm, but it nevertheless caused severe damage and flooding, particularly in southern and central Vermont and eastern New York. Historically, such storms are not uncommon in New England; tropical storms and hurricanes regularly track across the region, with notably large or deadly storms having struck in 1635, 1915, 1938, 1944, and 1999.

What is the ant's-eye view of such storms? Flooding can create the kind of disturbed habitat that favors the invasive species *Myrmica rubra,* but those habitat effects are quite transient. Downed trees open up the canopy and also increase the supply of fallen wood in which many species nest. Heavy flooding and rain can kill many ant colonies, but the areas affected are fairly small, and the losses are miniscule compared to the total population of ants in the area. Overall, a single storm is likely to have only negligible effects on regional populations and assemblages of ants.

However, as global warming proceeds, the intensity and frequency of such major storms are expected to increase. More frequent, larger storms not only may displace large numbers of people on the populous eastern seaboard, but also may have larger, accumulating impacts on ants, especially those with geographically restricted distributions.

Perhaps more important than severe storms, however, are the increasing temperatures that will occur as the concentrations of greenhouse gases, especially carbon dioxide and methane, increase in the atmosphere, trapping Earth's radiant heat. In 2012, New England has a climate much like Pennsylvania had in 1990. Even the most conservative and cautious modeling scenarios forecast that the climate in northern Maine 100 years from now will be comparable to the current climate in Washington, D.C. Warm temperatures will allow southern species to expand their ranges northward into New England, but only if the right habitats are available for them. At the same time, species that currently occur in far northern New England or on our highest mountain peaks are likely to shift their ranges northward and may be lost from the ant fauna of New England.

Ecologists and biogeographers are currently mapping the geographic ranges of species onto measures of contemporary climate and temperature and then using climate-change models to forecast local extinctions and shifts in the geographic ranges. Some of these forecasts are indeed alarming. In the worst-case scenarios (which are not entirely far-fetched), a future edition of this book might have to be renamed *A Field Guide to the Ants of Northern Quebec.* We might find ourselves using early 21st-century species

lists from Georgia and the Carolinas to identify the ant species of New England a hundred years from now.

But even with increased warming, there are two important reasons that all of these projected range shifts may not come to pass. The first is that ant colonies function as highly efficient superorganisms that maintain a great deal of control over their thermal environment. Just as humans are able to live in extreme climates by artificially cooling or heating their homes and cars, ants can maintain fairly constant nest temperatures in the face of fluctuating climatic conditions. Acclimation, habitat modification, and changes in foraging behavior, nest construction, and colony growth may allow some ant species to stay in place even in the face of substantial climatic change.

The second reason that some ant species may not shift their ranges is that ants have great potential for evolutionary change. The populations of many ant species number in the millions, which likely include a huge reservoir of genetic variation in numerous traits, including thermal tolerance. If temperatures change and some genetic variants are not able to persist, we can expect natural selection to quickly fill the void because genes promoting enhanced heat tolerance will quickly spread through a rapidly evolving population.

The ants of New England will certainly change with the climate, although direct responses to patterns of human movement and changes in land use are likely to be at least as important as responses to increasing temperature. If we humans do not manage to quickly control and reduce the increasing concentrations of atmospheric greenhouse gasses, our own livelihood and survival as a species will be threatened. But even long after we are gone, the ants of New England will certainly still be here.

Bibliography and Further Readings

In order to make the text easy to read, we have avoided in-text citations and footnotes or endnotes. But the keys and detailed natural history information included in this field guide build on more than a hundred years of ecological, evolutionary, and taxonomic research about ants. This bibliography provides an entrée into myrmecological research at a number of levels. Many of the general works will be accessible to budding myrmecologists of all ages. All are delightful to read and chock-full of interesting natural history observations. The systematic and taxonomic works reflect the sources we drew on for the names of ants and their evolutionary relationships. Although we are now in a period of relative calm and stability with respect to naming the subfamilies and genera of ants, the regular discovery of new species often prompts revisions and renaming of species and species complexes within genera. Finally, the technical papers on ant biology and ecology harbor detailed information on the relationship between ants and their environment, interactions among different species of ants, and the constant battles between ants and their prey, parasites, and predators. For each of the references in all three sections, we provide a short summary of why we found it useful and how it contributed to this field guide.

General Books and Introductions to Myrmecology

Agosti, Donat, Jonathan D. Majer, Leeanne E. Alonso, and Ted R. Schultz, eds. 2000. *Ants: Standard Methods for Measuring and Monitoring Biodiversity.* Smithsonian Institution Press, Washington, DC. [The bible for sampling and monitoring ants]

Eiseman, Charley, and Noah Charney. 2010. *Tracks and Sign of Insects and Other Invertebrates: A Guide to North American Species.* Stackpole Books, Mechanicsburg, PA. [An award-winning and innovative field guide to the spoor and fewmets of insects]

Fisher, Brian L., and Stefan P. Cover. 2007. *Ants of North America: A Guide to the Genera.* University of California Press, Berkeley. [A contemporary key to the ant genera of North America. The main reference for the annual Ant Course, described under Internet Resources.]

Gordon, Deborah M. 2011. *Ant Encounters: Interaction Networks and Colony Behavior.* Princeton University Press, Princeton, NJ. [An intriguingly different take: ant colonies as complex systems, not genetically programmed superorganisms]

Hansen, Laurel D., and John H. Klotz. 2005. *Carpenter Ants of the United States and Canada.* Comstock Publishing Associates, Ithaca, NY. [A good review of *Camponotus,* including the anatomy, physiology, ecology, and management of carpenter ants]

Hölldobler, Bert, and Edward O. Wilson. 1990. *The Ants.* Harvard University Press, Cambridge, MA. [A richly illustrated Pulitzer Prize–winning book about ants of the entire world]

———. 2008. *The Superorganism: The Beauty, Elegance, and Strangeness of Insect Societies.* W. W. Norton, New York. [The title says it all.]

Klotz, John, Laurel Hansen, Reiner Pospischil, and Michael Rust. 2008. *Urban Ants of North America and Europe: Identification, Biology, and Management.* Comstock Publishing Associates, Ithaca, NY. [A useful compendium of exotic and nuisance ants, with discussion of management]

Lehrer, Jonah. 2012. Kin and kind. *New Yorker,* March 5, 2012, 36–42. [A gentle introduction to the recent debate on the relative importance of kin selection, haplodiploidy, and other factors in the evolution of altruism. Read this before reading the 2010 technical article by Martin Nowak et al.]

Nichols, Stephen W. 1989. *The Torre-Bueno Glossary of Entomology.* New York Entomological Society, New York. [A revised, updated, and expanded edition of José Rollin de la Torre-Bueno's 1937 *Glossary of Entomology,* itself an expanded version of John B. Smith's 1906 *An Explanation of Terms Used in Entomology.* This unfortunately out-of-print book is an indispensable guide to the morass of technical terms used in describing insect anatomy; used book sellers occasionally turn up a copy.]

Sleigh, Charlotte. 2003. *Ant.* Reaktion Books, London. [An engaging overview of ants, their interactions with people, and how we respond to them]

Systematic and Taxonomic Works

Bolton, Barry. 1999. Ant genera of the tribe Dacetonini (Hymenoptera: Formicidae). *Journal of Natural History* 33: 1639–1689. [The resuscitation of *Pyramica* from the clutches of *Strumigenys;* will it survive ongoing molecular analysis?]

———. 2000. The ant tribe Dacetini, with a revision of the *Strumigenys* species of the Malagasy region by Brian L. Fisher, and a revision of the Austral epopostrumiform genera by Steven O. Shattuck. *Memoirs of the American Entomological Institute* 65: 1–1028. [Includes an excellent key to the North American species of *Pyramica,* along with the first description of *Pyramica metazytes*]

Bolton, Barry, Gary Alpert, Philip S. Ward, and Piotr Naskrecki. 2006. *Bolton's Catalogue of Ants of the World: 1758–2005.* Harvard University Press, Cambridge, MA. [The definitive reference for currently accepted names of ants, updated regularly at http://gap.entclub.org/. The names we use in this book are based on the January 2012 version.]

Bradley, G. A., and J. D. Hinks. 1968. Ants, aphids, and Jack pine in Manitoba. *Canadian Entomologist* 100: 40–50. [An interesting study of plant–ant–aphid interactions that describes both facultative and obligate interactions between ants (*Formica obscuripes* and *Dolichoderus taschenbergi*) and aphids]

Branstetter, Michael G. 2009. The ant genus *Stenamma* Westwood (Hymenoptera: Formicidae) redefined, with a description of a new genus *Propodilobus. Zootaxa* 2221: 41–57. [A circumscription of *Stenamma* based on both morphological and molecular data]

Brown, William L., Jr. 1953. Revisionary studies in the ant tribe Dacetini. *American Midland Naturalist* 50: 1–137. [Especially useful for its discussion of standard measurements of ants]

———. 1955. The ant *Leptothorax muscorum* (Nylander) in North America. *Entomological News* 66: 43–50. [A first attempt to bring order to the chaos of *Leptothorax;* largely superseded by Francoeur's more recent work]

Buren, William F. 1958. A review of the species of *Crematogaster* sensu stricto in North America (Hymenoptera: Formicidae), Part I. *Journal of the New York Entomological Society* 66: 119–134. [The first part of Buren's Ph.D. dissertation and the starting point for current understanding of this genus]

———. 1968a. Some fundamental taxonomic problems in *Formica* (Hymenoptera: Formicidae). *Journal of the Georgia Entomological Society* 3: 25–40. [Resolves some of the group-level taxonomy of the slave-making *Formica* species]

———. 1968b. A review of the species of *Crematogaster* sensu stricto in North America (Hymenoptera: Formicidae), Part II: Descriptions of new species. *Journal of the Georgia Entomological Society* 3: 91–121. [The second part of Buren's Ph.D. dissertation and still the best key to the North American members of this genus]

Coovert, Gary A. 2005. *The Ants of Ohio*. Ohio Biological Survey, Columbus. [A useful introduction, good keys, and many beautiful illustrations of many ants of eastern North America, although some of the nomenclature is now out of date]

Creighton, William S. 1950. The ants of North America. *Bulletin of the Museum of Comparative Zoology*, no. 104. [Out of print but available as a free PDF online at http://www.archive.org/details/ants_06224. Creighton's work is still the only comprehensive key to North American ant species, although rendered partially obsolete by many of the other systematic works listed here.]

DuBois, Mark B. 1986. A revision of the native New World species of the ant genus *Monomorium* (*minimum* group) (Hymenoptera: Formicidae). *University of Kansas Science Bulletin* 53: 65–119. [The current definitive revision of our native *Monomorium* species. Includes the original description of *M. emarginatum*.]

———. 1998. A revision of the ant genus *Stenamma* in the Palearctic and Oriental regions. *Sociobiology* 32: 192–404. [Although focused on the "Old World," this article has excellent historical information on the overall classification of *Stenamma*.]

Francoeur, André. 1973. Révision taxonomique des espèces néarctiques du groupe *Fusca*, genre *Formica* (Formicidae, Hymenoptera). *Memoires de la Société Entomologique du Québec* 3: 1–316. [The definitive revision of the *Formica fusca* group]

———. 1986. Deux nouvelles fourmis Néarctiques: *Leptothorax retractus* et *L. sphagnicolus* (Formicidae, Hymenoptera). *Canadian Entomologist* 118: 1151–1164. [The first description of these two *Leptothorax* species, with other observations on the genus]

———. 1997. Ants (Hymenoptera: Formicidae) of the Yukon. Pp. 901–910 in H. V. Danks and J. A. Downes, eds., *Insects of the Yukon*. Biological Survey of Canada, Ottawa. [Includes a discussion of our current understanding of *Myrmica lobifrons*]

———. 2007. The *Myrmica punctiventris* and *Myrmica crassirugis* species groups in the Nearctic region. *Memoirs of the American Entomological Institute* 80: 153–185. [The first description of *Myrmica semiparasitica*, along with other observations on the *punctiventris* species group]

Francoeur, André, Robert Loiselle, and Alfred Buschinger. 1985. Biosystématique de la tribu Leptothoracini (Formicidae, Hymenoptera), Pars 1: Le genre *Formicoxenus* dans la région holarctique. *Naturaliste Canadien* 112: 343–403. [The

benchmark for this genus, with natural history, morphometrics, and a key to *Formicoxenus* species]

Heinze, Jürgen. 1989. *Leptothorax wilsoni* n. sp., a new parasitic ant from eastern North America (Hymenoptera: Formicidae). *Psyche* 96: 49–61. [The first description of this species, along with observations on social parasitism in *Leptothorax*]

Johnson, Clifford. 1989. Identification and nesting sites of North American species of *Dolichoderus* Lund (Hymenoptera: Formicidae). *Insecta Mundi* 3: 1–9. [A useful key to *Dolichoderus* in North America, with a discussion of a potentially new species from Massachusetts]

Kennedy, Clarence H., and Clyde A. Dennis. 1937. New ants from Ohio and Indiana, *Formica prociliata, F. querquetulana, F. postoculata,* and *F. lecontei* (Formicidae: Hymenoptera). *Annals of the Entomological Society of America* 30: 531–544. [Systematics and ecology of various *Formica microgyna*–group species]

LaPolla, John S., Seán G. Brady, and Steven O. Shattuck. 2010. Phylogeny and taxonomy of the *Prenolepis* genus-group of ants (Hymenoptera: Formicidae). *Systematic Entomology* 35: 118–131. [A revision of *Prenolepis, Paratrechina, Nylanderia,* and related genera based on DNA sequence data and morphological characters]

Mackay, William P. 1993. A review of the New World ants of the genus *Dolichoderus* (Hymenoptera: Formicidae). *Sociobiology* 22: 1–148. [The definitive taxonomic revision of the genus for the Western Hemisphere. Discounts *Dolichoderus* sp. A of Johnson 1989 as a variant of *D. pustulatus.*]

———. 2000. A review of the New World ants of the subgenus *Myrafant* (genus *Leptothorax*) Hymenoptera: Formicidae. *Sociobiology* 36: 263–444. [The most recent taxonomic revision of what we now call *Temnothorax*]

Radchenko, Andrew G., and Graham W. Elmes. 2010. *Myrmica* ants (Hymenoptera: Formicidae) of the Old World. *Fauna Mundi,* Vol. 3. Natura Optima Dux Foundation, Warsaw, Poland. [A thorough revision of the Palearctic *Myrmica* species; the base reference for any future revisionary work on this genus]

Schlick-Steiner, Birget C., Florian M. Steiner, Karl Moder, Bernhard Seifert, Matthias Sanetra, Eric Dyreson, Christian Stauffer, and Erhard Christian. 2006. A multidisciplinary approach reveals cryptic diversity in Western Palearctic *Tetramorium* ants (Hymenoptera: Formicidae). *Molecular Phylogenetics and Evolution* 40: 259–273. [Separates the European *Tetramorium caespitum / impurum* complex into seven species and assigns "Species E" to the North American *T. caespitum*]

Seifert, Bernhard. 2003. The ant genus *Cardiocondyla* (Insecta: Hymenoptera: Formicidae)—a taxonomic revision of the *C. elegans, C. bulgarica, C. batesii, C. nuda, C. shuckardi, C. stambuloffii, C. wroughtonii, C. emeryi,* and *C. minutior* species groups. *Annalen des Naturhistorischen Museums in Wien* 104B: 203–338. [The most recent revision and key to the genus *Cardiocondyla*]

Shattuck, Steven O. 1992. Generic revision of the ant subfamily Dolichoderinae (Hymenoptera: Formicidae). *Sociobiology* 21: 1–180. [A reworking of the Dolichoderinae and reassignment of *Hypoclinea* within *Dolichoderus*]

Smith, Marion R. 1939. The North American ants of the genus *Harpagoxenus* Forel,

with the description of a new species (Hymenoptera: Formicidae). *Proceedings of the Entomological Society of Washington* 41: 165–172. [A description of *H. canadensis*, along with discussion of the slave-making habits of *H. americanus*, which was later renamed *Protomognathus americanus*]

———. 1947. A study of *Polyergus* in the United States, based on the workers (Hymenoptera: Formicidae). *American Midland Naturalist* 38: 150–161. [A systematic study of *Polyergus;* now dated, but it would be the starting point for any future, much-needed revision of this genus.]

———. 1957. Revision of the genus *Stenamma* Westwood in America North of Mexico (Hymenoptera: Formicidae). *American Midland Naturalist* 57: 133–174. [Still the best key to the Nearctic *Stenamma* plus a synthesis of available natural history information]

Snelling, Roy R. 1970. Studies on California ants, Part 5: Revisionary notes on some species of *Camponotus*, subgenus *Tanaemyrmex* (Hymenoptera: Formicidae). *Proceedings of the Entomological Society of Washington* 72: 390–397. [A review and taxonomic revision of one group of carpenter ants]

———. 1988. Taxonomic notes on Nearctic species of *Camponotus*, subgenus *Myrmentoma* (Hymenoptera: Formicidae). Pp. 55–78 in James C. Trager, ed., *Advances in Myrmecology*. E. J. Brill, New York. [A review and taxonomic revision of one group of carpenter ants]

Snelling, Roy R., and William F. Buren. 1985. Description of a new species of slave-making ant in the *Formica sanguinea* group (Hymenoptera: Formicidae). *Great Lakes Entomologist* 18: 69–78. [An excellent key to the slave-making *Formica* species]

Taylor, Robert W. 1967. A monographic revision of the ant genus *Ponera* Latreille (Hymenoptera: Formicidae). *Pacific Insects Monograph* 13: 1–112. [Restores *Hypoponera* to generic status and provides useful natural history and biogeography of *Ponera* and *Hypoponera*]

Trager, James C. 1984. A revision of the genus *Paratrechina* (Hymenoptera: Formicidae) of the continental United States. *Sociobiology* 9: 51–162. [A thorough revision and analysis of *Paratrechina*, including what is now the genus *Nylanderia*]

———. 2001. A revision of the fire ants, *Solenopsis geminata* group (Hymenoptera: Formicidae: Myrmicinae). *Journal of the New York Entomological Society* 99: 141–198. [This revision of the fire ants of the world is especially useful for identifying rogue *Solenopsis* species.]

———. 2012. Global revision of *Polyergus* (Hymenoptera: Formicidae: Formicinae, Formicini). Unpublished manuscript.

Trager, James C., Joe A. MacGown, and Matthew D. Trager. 2007. Revision of the Nearctic endemic *Formica pallidefulva* group. *Memoirs of the American Entomological Institute* 80: 610–636. [A revision of the North American "*Neoformica*" group of *Formica* species]

Umphrey, Gary J. 1996. Morphometric discrimination among sibling species in the *fulva-rudis-texana* complex of the ant genus *Aphaenogaster* (Hymenoptera: Formicidae). *Canadian Journal of Zoology* 74: 528–559. [The starting point for systematics of the North American *Aphaenogaster rudis* complex]

Urbani, Cesare Baroni, and Maria L. de Andrade. 2003. The ant genus *Proceratium* in the extant and fossil record (Hymenoptera: Formicidae). *Museo Regionale di Scienze Naturali,* Turin, Monografie 36. [A thorough taxonomic revision of all of *Proceratium*]

———. 2007. The ant tribe Dacetini: Limits and constituent genera, with descriptions of new species (Hymenoptera: Formicidae). *Annali del Museo Civico di Storia Naturale "G. Doria," Genova* 99: 1–191. [A recent salvo in the debate over whether *Pyramica* is a valid genus or whether it should be subsumed within *Strumigenys*]

Ward, Philip S. 2005. A synoptic review of the ants of California (Hymenoptera: Formicidae). *Zootaxa* 936: 1–68. [Returns *Acanthomyops* to subgeneric status within *Lasius*]

———. 2007. Phylogeny, classification, and species-level taxonomy of ants (Hymenoptera: Formicidae). *Zootaxa* 1668: 549–563. [A review of familywide taxonomy of ants, still current to 2010]

———. 2010. Taxonomy, phylogenetics, and evolution. Pp. 3–17 in Lori Lach, Catherine L. Parr, and Kirsti L. Abbott, *Ant Ecology.* Oxford University Press, Oxford, England. [A review of our current understanding of subfamily relationships within the ants, as illustrated on p. 17]

Wheeler, George C., and Jeanette Wheeler. 1963. *The Ants of North Dakota.* University of North Dakota Press, Grand Forks. [A regional guide but with good information on many prairie species that extend into Down East Maine. It is also notable for its excellent illustrations of the antennal scapes of *Myrmica.*]

Wheeler, William Morton. 1906. Fauna of New England: List of the Formicidae. Occasional Paper 7. Boston Society of Natural History, Boston, MA. [The first checklist of the ants of New England]

———. 1916. Questions of nomenclature connected with the ant genus *Lasius* and its subgenera. *Psyche* 23: 168–173. [A romp through the Jurinean controversy surrounding the use of the name *Lasius*]

Wilson, Edward O. 1955. A monographic revision of the ant genus *Lasius. Bulletin of the Museum of Comparative Zoology* 113: 1–205. [The primary source for all *Lasius* outside of the *claviger* group]

———. 2003. Pheidole *in the New World: A Dominant, Hyperdiverse Ant Genus.* Harvard University Press, Cambridge, MA. [A magisterial overview and thorough systematic revision of *Pheidole*]

Wing, Merle W. 1968. Taxonomic revision of the Nearctic genus *Acanthomyops* (Hymenoptera: Formicidae). *Memoirs of the Cornell University Agricultural Experiment Station,* no. 405. [A thorough review of the systematics, ecology, and hybridization of species in the *Lasius claviger* group]

Yoshimura, Masahi, and Brian L. Fisher. 2012. A revision of male ants of the Malagasy Amblyoponinae (Hymenoptera: Formicidae) with resurrections of the genera *Stigmatomma and Xymmer. PLoS ONE* 7: e33325.

Technical Papers on Ant Ecology and Evolution

Archibald, S. Bruce, Kirk R. Johnson, Rolf W. Mathewes, and David R. Greenwood. 2011. Intercontinental dispersal of giant thermophilic ants across the Arctic

during early Eocene hyperthermals. *Proceedings of the Royal Society B.* doi: 10.1098/rpsb.2011.0729. [The first description of the extinct Lube's Giant Ant and a discussion of the relationship between ant size and climate]

Berman, Daniil I., Arkady V. Alfimov, Zoya A. Zhigulskaya, and Anna N. Leirikh. 2010. *Overwintering and Cold-Hardiness of Ants in the Northeast of Asia.* Pensoft, Sofia, Bulgaria. [Summarizes detailed physiological studies on ants in the tundra and taiga of Siberia. One of our New England species with a Holarctic distribution, *Camponotus herculeanus,* is discussed in detail.]

Bono, Jeremy M., and Joan M. Herbers. 2003. Proximate and ultimate control of sex ratios in *Myrmica brevispinosa* colonies. *Proceedings of the Royal Society of London B,* 270: 811–817. [An experimental study of food limitation on queen production in *Myrmica brevispinosa,* along with good natural history information on this species]

Brady, Seán G., Ted R. Schultz, Brian L. Fisher, and Philip S. Ward. 2006. Evaluating alternative hypotheses for the early evolution and diversification of ants. *Proceedings of the National Academy of Sciences, USA* 103: 18172–18177. [An analysis of the relationships among subfamilies of ants based on DNA data]

Buczkowski, Grzegorz. 2010. Extreme life history plasticity and the evolution of invasive characteristics in a native ant. *Biological Invasions* 12: 3343–3349. [Observations of colony structure in natural and urban populations of *Tapinoma sessile*]

Buschinger, Alfred. 2009. Social parasitism among ants: A review (Hymenoptera: Formicidae). *Myrmecological News* 12: 219–235. [A recent review of the distribution and evolution of social parasitism and slave-making in ants that also clarifies the names given to different types of social parasitism in ants]

Creighton, William S. 1927. The slave-raids of *Harpagoxenus americanus. Psyche* 34: 11–29. [Detailed descriptions of the behavior of *Protomognathus americanus,* together with a discussion and illustration of the males]

Cushing, Paula E. 1997. Myrmecomorphy and myrmecophily in spiders: A review. *Florida Entomologist* 80: 165–193. [The most recent review of ant mimicry by spiders]

Ellison, Aaron M. 2012. The ants of Nantucket: Unexpectedly high biodiversity in an anthropogenic landscape. *Northeastern Naturalist* 19 (Special Issue 6): 43–66.

Ellison, Aaron M., Elizabeth J. Farnsworth, and Nicholas J. Gotelli. 2002. Ant diversity in pitcher-plant bogs of Massachusetts. *Northeastern Naturalist* 9: 267–284. [The biogeography of a regional ant assemblage based on our work documenting the distribution of *Myrmica lobifrons* in southern New England]

Ellison, Aaron M., Sydne Record, Alex Arguello, and Nicholas J. Gotelli. 2007. Rapid inventory of the ant assemblage in a temperate hardwood forest: Species composition and assessment of sampling methods. *Environmental Entomology* 36: 766–775. [How to do quantitative hand sampling in northeastern forests]

Espadaler, X., and L. López-Soria. 1991. Rareness of certain Mediterranean ant species: Fact or artifact? *Insectes Sociaux* 38: 365–377. [On the importance of sampling ants in one's own backyard]

Francoeur, André, and Claude Pilon. 2011. Découverte, au Québec, de la fourmi parasite *Anergates atratulus* (Formicidae, Hymenoptera). *Naturaliste Canadien* 135: 30–34. [A range extension of *Anergates,* along with exquisite photographs]

Gotelli, Nicholas J., and Aaron M. Ellison. 2002. Biogeography at a regional scale: Determinants of ant species density in New England bogs and forests. *Ecology* 83: 1604–1609. [The biogeography of ants in bogs and forests of Massachusetts and Vermont]

Gotelli, Nicholas J., Aaron M. Ellison, Robert R. Dunn, and Nathan J. Sanders. 2011. Counting ants (Hymenoptera: Formicidae): Biodiversity sampling and statistical analysis for myrmecologists. *Myrmecological News* 15: 13–19. [Statistical methods for analyzing ant data]

Hamilton, William D. 1967. Extraordinary sex ratios. *Science* 156: 477–488. [A general description of the theory of inclusive fitness, which has been used to explain the evolution of eusociality in ants and other animals]

Heinze, Jürgen, Sylvia Cremer, N. Eckl, and Alexandra Schrempf. 2006. Stealthy invaders: The biology of *Cardiocondyla* tramp ants. *Insectes Sociaux* 53: 1–7. [A good review of the ecology and evolution not only of *Cardiocondyla* but also of other tropical tramp species]

Heraty, John M., Joanne M. Heraty, and Javier Torrés. 2009. A new species of *Pseudochalcura* (Hymenoptera, Eucharitidae), with a review of antennal morphology from a phylogenetic perspective. *ZooKeys* 20: 215–231. [Includes a discussion of parasitism of *Camponotus* spp. by this wasp]

Herbers, Joan M. 1985. Seasonal structuring of a north temperate ant community. *Insectes Sociaux* 32: 224–240. [On the general ecology of ants in the northeastern United States]

———. 2011. Nineteen years of field data on ant communities (Hymenoptera: Formicidae): What can we learn? *Myrmecological News* 15: 43–52. [On the beauty of long-term research on ants, including data from West Virginia, New York, and Vermont]

Herbers, Joan M., and Susanne Foitzik. 2002. The ecology of slavemaking ants and their hosts in north temperate forests. *Ecology* 83: 148–163. [A 20-year ecological study of *Protomognathus americanus* and its *Temnothorax* hosts in Vermont and New York]

Jennings, Daniel T., Mark W. Houseweart, and André Francoeur. 1986. Ants (Hymenoptera: Formicidae) associated with strip-clearcut and dense spruce-fir forests of Maine. *Canadian Entomologist* 118: 43–50. [On the diversity of ants in forests infested by spruce budworm in northern Maine]

Jurgensen, Martin F., Andrew J. Storer, and Anita C. Risch. 2005. Red wood ants in North America. *Annales Zoologici Fennici* 42: 235–242. [An interesting comparison of *Formica rufa*–group ants in Europe and North America]

Kannowski, Paul B. 1959. The flight activities and colony-founding behavior of bog ants in southeastern Michigan. *Insectes Sociaux* 6: 9–162. [Excellent natural history observations on a variety of bog ants, including *Ponera, Myrmica, Temnothorax, Tapinoma, Dolichoderus, Camponotus, Lasius,* and *Formica* spp.]

Kronauer, Daniel J. C., and Naomi E. Pierce. 2011. Myrmecophiles. *Current Biology* 21: R208–R209. [A general overview of ant guests]

LaFleur, Benoit, William F. J. Parsons, Robert L. Bradley, and André Francoeur. 2006. Ground-nesting ant assemblages and their relationship to habitat factors along a chronosequence of postfire-regenerated lichen-spruce woodland. *Environ-*

mental Entomology 35: 1515–1524. [On the community ecology of various boreal *Formica* and *Myrmica* species]

Lyford, Walter L. 1963. Importance of ants to brown podzolic soil genesis in New England. Harvard Forest Paper 7, Harvard Forest, Petersham, MA. Available online at http://harvardforest.fas.harvard.edu/publications/pdfs/HFpubs/paper7.pdf. [A detailed investigation of how much soil ants can move in the glacially derived soils of north-central Massachusetts]

Marlin, John C. 1971. The mating, nesting and ant enemies of *Polyergus lucidus* Mayr (Hymenoptera: Formicidae). *American Midland Naturalist* 86: 181–189. [A thorough study of the field ecology of this unique slave-making ant; James Trager notes that the species studied was actually *Polyergus montivagus*.]

McIver, James D., and Gary M. Stonedahl. 1987. Biology of the myrmecomorphic plant bug *Orectoderus obliquus* Uhler (Heteroptera: Miridae: Phylinae). *Journal of the New York Entomological Society* 95: 278–289. [A description and analysis of the temporal mimicry of ants by *O. obliquus*]

———. 1993. Myrmecomorphy: Morphological and behavioral mimicry of ants. *Annual Review of Entomology* 38: 351–379. [The most recent review of ant mimicry across the arthropods]

Menke, Sean B., Warren Booth, Robert R. Dunn, Coby Schal, Edward L. Vargo, and Jules Silverman. 2010. Is it easy to be urban? Convergent success in urban habitats among lineages of a widespread native ant. *PLoS ONE* 5: e9194. [A genetic analysis of urban and rural *Tapinoma sessile* in different parts of North America]

Ness, Josh H., D. F. Morin, and Itamar Giladi. 2009. Uncommon specialization in a mutualism between a temperate herbaceous plant guild and an ant: Are *Aphaenogaster* ants keystone mutualists? *Oikos* 118: 1793–1804. [A detailed study of seed dispersal by *Aphaenogaster* in northeastern forests]

Nowak, Martin A., Corina E. Tarnita, and Edward O. Wilson. 2010. The evolution of eusociality. *Nature* 466: 1057–1062. [A new theory for the evolution of eusociality that does not depend on kin selection and inclusive fitness]

Ortius, Diethe. 1995. A *Dolichoderus taschenbergi* queen found in a polygynous colony of *D. plagiatus* (Hymenoptera: Formicidae). *Psyche* 102: 147–150. [The only observation of social parasitism by *D. taschenbergi*. Also describes polygyny in *D. plagiatus,* which is otherwise considered uncommon. These observations were made in Maine.]

Ouellette, Gary D., Francis A. Drummond, Beth Choate, and Eleanor Groden. 2010. Ant diversity and distribution in Acadia National Park, Maine. *Environmental Entomology* 39: 1447–1456. [A summary of the 2003 Ant Blitz at Acadia National Park and a comparison with Proctor's 1946 biotic survey of the park's Mount Desert Island]

Pećarević, Marko, James Danoff-Burg, and Robert R. Dunn. 2010. Biodiversity on Broadway—Enigmatic diversity of the societies of ants (Formicidae) on the streets of New York City. *PLoS ONE* 5: e13222. [On the diversity of ants in median strips of Manhattan. Includes lots of interesting natural history on exotic species.]

Peck, Stewart B., and Joyce Cook. 2007. Systematics, distributions, and bionomics of the *Neoeocatops* gen. nov. and *Nemadus* of North America (Coleoptera:

Leiodidae: Cholevinae: Anemadini). *Canadian Entomologist* 139: 87–117. [About a group of beetles, some of which live as inquilines and scavengers in *Camponotus* nests]

Pierce, Naomi E., Michael F. Braby, Alan Heath, David J. Lohman, John Mathew, Douglas B. Rand, and Mark A. Travassos. 2002. The ecology and evolution of ant association in the Lycaenidae (Lepidoptera). *Annual Review of Entomology* 47: 733–771. [A current survey of the most important group of myrmecophilous butterflies]

Rolstad, Jørund, and Erlend Rolstad. 2000. Influence of large snow depths on black woodpecker *Dryocopus martius* foraging behavior. *Ornis Fennica* 77: 65–70. [On birds that depend on *Camponotus* for winter food]

Scharf, Michael E., C. R. Ratliff, and Gary W. Bennett. 2004. Impacts of residual insecticide barriers on perimeter-invading ants, with particular reference to the odorous house ant, *Tapinoma sessile. Journal of Economic Entomology* 97: 601–605. [Presents evidence for the hypothesis that killing off ants with insecticide may provide an opportunity for *T. sessile* to expand into houses]

Seppä, Perttu, and P. Gertsch. 1996. Genetic relatedness in the ant *Camponotus herculeanus:* A comparison of estimates from allozyme and DNA microsatellite markers. *Insectes Sociaux* 43: 235–246. [A study of *Camponotus* from throughout its Holarctic range]

Stuart, Robin J., and Thomas M. Alloway. 1983. The slave-making ant *Harpagoxenus canadensis* M. R. Smith and its host-species, *Leptothorax muscorum* (Nylander): Slave raiding and territoriality. *Behaviour* 85: 58–90. [A thorough study of slave-making behavior in *H. canadensis*]

Swenson, Jon E., Anna Jansson, Raili Riig, and Finn Sandegren. 1999. Bears and ants: Myrmecophagy by brown bears in central Scandinavia. *Canadian Journal of Zoology* 77: 551–561. [On bears that depend on *Camponotus* for winter food]

Talbot, Mary. 1963. Local distribution and flight activities of four species of ants of the genus *Acanthomyops* Mayr. *Ecology* 44: 549–557. [Interesting natural history of the *Lasius claviger* group in Michigan]

———.1965. Populations of ants in a low field. *Insectes Sociaux* 12: 19–48. [Detailed natural history of a wide range of ants living in wet and dry fields in southern Michigan]

Traniello. James F. A. 1982. Population structure and social organization in the primitive ant *Amblyopone pallipes* (Hymenoptera: Formicidae). *Psyche* 89: 65–80. [Detailed observations on *Stigmatomma* ecology and behavior]

Wetterer, James K. 2010. Worldwide spread of the flower ant, *Monomorium floricola* (Hymenoptera: Formicidae). *Myrmecological News* 13: 19–27. [A compilation of all known distributional data on this tramp species, along with useful information on its natural history]

Wheeler, George C., Jeannette N. Wheeler, and Paul B. Kannowski. 1994. Checklist of the ants of Michigan (Hymenoptera: Formicidae). *Great Lakes Entomologist* 26: 297–310. [More than a checklist, this article is rich in natural history and nest habitats of many species of ants.]

Wheeler, William Morton. 1905. An interpretation of the slave-making instincts in ants. *Bulletin of the American Museum of Natural History* 21: 1–16. [An early

classification of different types of social parasitism and slave-making in ants. Wheeler also takes the opportunity, in footnote 1 on page 3 of the article, to identify *Protomognathus* as a genus distinct from *Tomognathus*.]

———. 1908a. Studies on myrmecophiles, Part I: *Cremastochilus*. *Journal of the New York Entomological Society* 16: 68–79. [A classic set of natural history observations on these "phlegmatic beetles"]

———. 1908b. Studies on myrmecophiles, Part II: *Hetaerius*. *Journal of the New York Entomological Society* 16: 135–143. [One of the first detailed studies of the natural history of this myrmecophilic beetle]

———. 1911. Notes on the myrmecophilous beetles of the genus *Xenodusa*, with a description of the larva of *X. cava* Leconte. *Journal of the New York Entomological Society* 19: 163–169. [A classic set of natural history observations on this beetle]

Wilson, Edward O., and Bert Hölldobler. 2005. The rise of the ants: A phylogenetic and ecological explanation. *Proceedings of the National Academy of Sciences, USA* 102: 7411–7414. [A short review of the evolutionary history of the ants and a nice summary of the "Ponerine paradox"—why species in this evolutionarily ancient lineage of ants with representatives around the world are so lacking in social organization]

All About Scientific Names

Brown, Ronald Wilbur. 1956. *Composition of Scientific Words*. Smithsonian Institution Press, Washington, DC. [A dictionary of scientific terms and the starting point for tracking down the etymology of scientific names or for creating new ones]

Buchanen, Robert E. 1956. Verbal stems in Latin composition. *International Bulletin of Bacteriological Nomenclature and Taxonomy* 6: 101–110. [A useful discussion of when the species name should agree in gender with the genus and when it need not, of particular importance in the *Leptothorax sphagnicolus* vs. *L. sphagnicola* controversy]

International Commission of Zoological Nomenclature. 2000. *International Code of Zoological Nomenclature*, 4th Edition. Current version available online at http://www.nhm.ac.uk/hosted-sites/iczn/code/. [*Robert's Rules of Order* for naming and renaming species of animals. There are similar codes for plants and fungi and for bacteria and prokaryotes.]

Nicolson, Dan H. 1987. Species epithets ending in *-cola*, a retraction concerning *-colus*, *-colum*. *Taxon* 36: 742–744. [Another useful discussion of when the species name should agree in gender with the genus and when it need not]

Trüper, Hans G., and Lanfranco de Clari. 1997. Taxonomic note: Correction of specific epithets formed as substantives (nouns) in apposition. *International Journal of Systematic Bacteriology* 47: 908–909. [Yet another useful discussion of when the species name should agree in gender with the genus and when it need not]

Internet Resources

There may be more Web sites devoted to ants than there are ants! We list a few of our favorites; any Web search engine will uncover many more. Please note that our listing of a commercial Web site is for informational purposes only and does not imply any endorsement of a particular product or company by the authors or by Yale University Press.

Web Sites Related to This Field Guide

http://NEAnts.net/	The official *Field Guide to the Ants of New England* Web site
http://tinyurl.com/antsNE	The Harvard Forest Data Archive file (HF-147), where all the data used to create the species distribution maps are stored.
http://www.pbase.com/tmurray74/	Tom Murray's photographs
http://entomofaune.qc.ca/Insectes_du_Quebec.html	Claude Pilon's photographs
http://www.texasento.net/	Mike Quinn's photographs
http://www.thomasshahan.com/	Thomas Shahan's photography and art
http://www.alexanderwild.com/	Alex Wild Photography

Where Professional Myrmecologists Hang Out

http://www.antweb.org/	Databases and images of ants of the world
http://www.antbase.org/	Current nomenclature and links to the original taxonomic literature
http://fm.cits.fcla.edu/fm.jsp	FORMIS, a master bibliography of the ant literature
http://gap.entclub.org/	Home of the Global Ant Project, it includes biographies of ant taxonomists, interactive keys to the ant genera, current versions of Barry Bolton's *Synopsis of the Formicidae and Catalogue of Ants of the World*, and lots of pointers to additional Web-based resources focused on ants.
http://www.antmacroecology.org/	Home of another Global Ants project, this one bringing together ant ecologists and evolutionary biologists focused on the distribution and abundance of ants and how they may respond to global climatic changes
http://research.calacademy.org/ent/courses/ant	Web site of the Ant Course, an annual course taught in the southwestern United States or overseas. The Ant Course is an

intensive 10-day workshop designed mainly for systematists, ecologists, behaviorists, conservation biologists, and other biologists whose research responsibilities require a greater understanding of ant taxonomy and field research techniques. Admission is by competitive application.

Other Fun and Useful Web Sites

http://schoolofants.org/	Web site of the School of Ants, an international project aimed at helping children and K–12 teachers explore urban backyard biodiversity
http://www.antscanada.com/	Web site of the AntsCanada Ant Store, which sells ant farms and supplies for building your own formicaria
http://www.antfarmcentral.com/	Web site of Ant Farm Central, a clearinghouse for information about ant farms
http://antfarm.yuku.com/	Web site of the Ant Farm and Myrmecology Forum, a moderated online forum on ant farms and myrmecology
http://www.bugguide.net/	Web site of BugGuide.net, an online community of naturalists who are interested in insects, spiders, and other creatures with lots of legs and an exoskeleton
http://www.discoverlife.org/	Web site of Discover Life, which provides free online tools that will help you to identify species, teach about them, report your observations, and create distribution maps
http://www.eol.org/	Web site of the Encyclopedia of Life, which is creating electronic species pages for every organism on Earth

Purveyors of Entomological Supplies, Hand Lenses, and Dissecting Microscopes

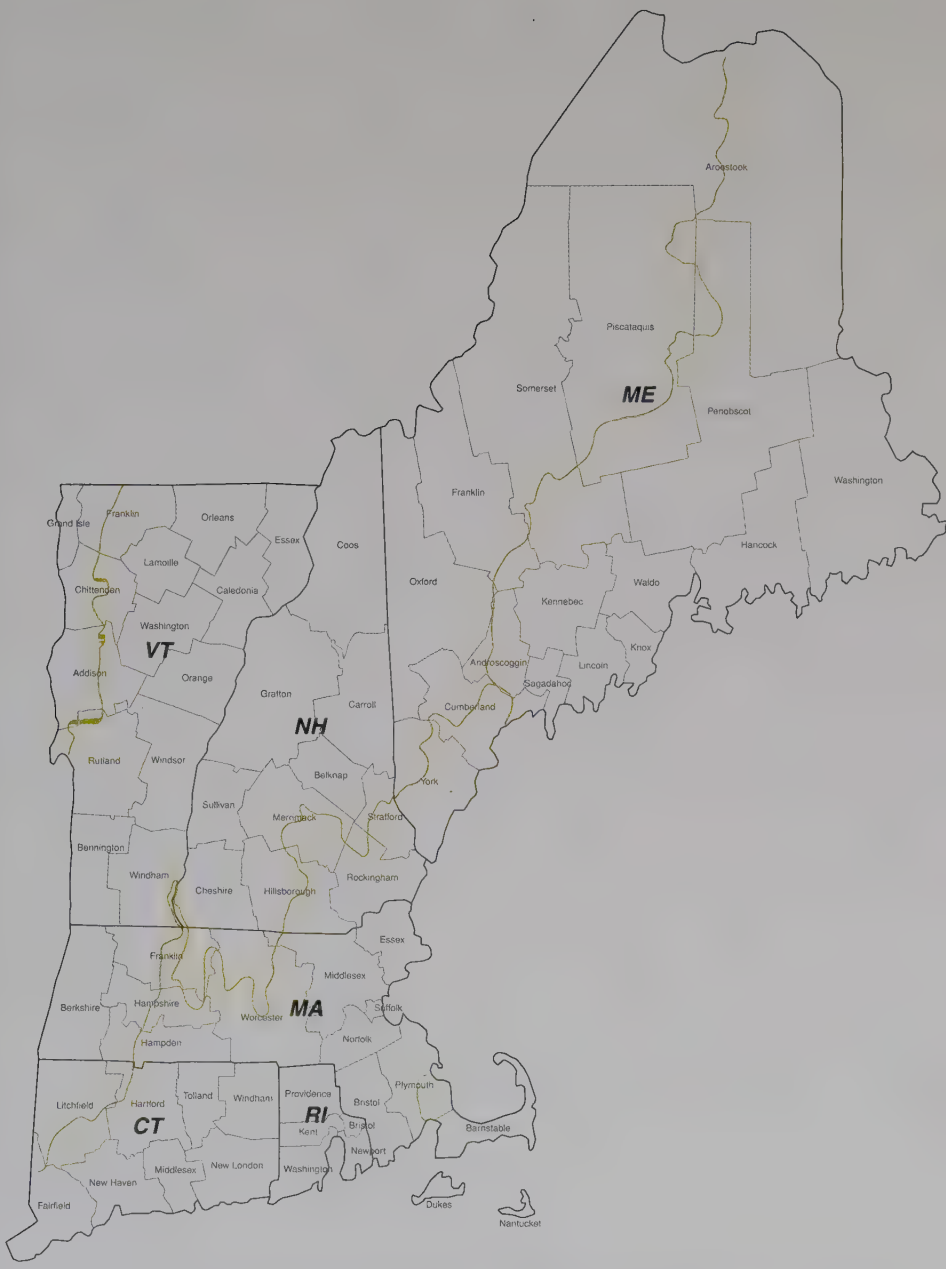
http://www.bioquip.com/	Web site of Bioquip, which sells collecting equipment, storage supplies, and books on all aspects of entomology
http://www.finescience.com/	Web site of Fine Science Tools, which sells precision forceps, scissors, and insect pins, among other handmade research tools

http://heliconsoft.com/	Web site of HeliconSoft, which sells software for capturing and rendering 3-D-like images through a microscope
http://www.martinmicroscope.com/	Web site of Martin Microscopes, which sells a wide range of affordable dissecting microscopes, both new and used
http://www.minerox.com/	Web site of Miners, Inc., which sells high-end hand lenses
http://www.riteintherain.com/	Web site of Rite in the Rain, which sells waterproof paper
http://www.roseentomology.com/	Web site of Rose Entomology, which sells collecting equipment, storage supplies, and clever manipulators for working with pinned specimens
http://www.santetraps.com/	Web site of Sante Traps, which sells specialty traps for collecting insects. They are a good source for Winkler collectors and litter-sampling bags.
http://www.sarstedt.com/	Web site of Sarstedt, a good source of 2-ml plastic vials with O-ring seals
http://www.scientificsonline.com/	Web site of Edmund Scientifics, which sells affordable hand lenses and dissecting microscopes
http://www.syncroscopy.com/	Web site of Syncroscopy, which sells cameras and software for capturing and rendering 3-D-like images through a microscope

Index

Bold page numbers indicate species description pages.

Counties of New England



Map of New England with its 67 counties and five ecoregions.

Checklist of the Ants of New England

The list that follows includes ants found in nearby areas.

*Native New England species known only from type specimens
† Native species found in parts of New York or Canada bordering New England but not yet recorded from New England
‡ Non-native species known to occur in New England
§ Non-native species found in parts of New York or Canada bordering New England but not yet recorded from New England

Poneroids (7 species)

- ❑ *Stigmatomma pallipes*
- ❑ *Hypoponera punctatissima*‡
- ❑ *Pachycondyla chinensis*§
- ❑ *Ponera pennsylvanica*
- ❑ *Proceratium crassicorne*
- ❑ *P. pergandei*
- ❑ *P. silaceum*

Dolichoderinae (7 species)

- ❑ *Dolichoderus mariae*
- ❑ *D. plagiatus*
- ❑ *D. pustulatus*
- ❑ *D. taschenbergi*
- ❑ *Tapinoma melanocephalum*‡
- ❑ *T. sessile*
- ❑ *T.* new species (an inquiline social parasite of *T. sessile*)

Formicinae (66 species)

- ❑ *Brachymyrmex depilis*
- ❑ *Camponotus americanus*
- ❑ *C. caryae*
- ❑ *C. castaneus*
- ❑ *C. chromaiodes*
- ❑ *C. herculeanus*
- ❑ *C. nearcticus*
- ❑ *C. novaeboracensis*
- ❑ *C. pennsylvanicus*
- ❑ *C. subbarbatus*†
- ❑ *Formica argentea*
- ❑ *F. aserva*
- ❑ *F. creightoni*
- ❑ *F. dakotensis*†
- ❑ *F. difficilis*
- ❑ *F. dirksi**
- ❑ *F. dolosa*
- ❑ *F. exsectoides*
- ❑ *F. glacialis*
- ❑ *F. hewitti*
- ❑ *F. impexa*
- ❑ *F. incerta*
- ❑ *F. integra*
- ❑ *F. knighti*
- ❑ *F. lasioides*
- ❑ *F. morsei**
- ❑ *F. neogagates*
- ❑ *F. neorufibarbis*
- ❑ *F. nepticula*
- ❑ *F. obscuriventris*
- ❑ *F. pallidefulva*
- ❑ *F. pergandei*
- ❑ *F. podzolica*
- ❑ *F. querquetulana*
- ❑ *F. reflexa*
- ❑ *F. rubicunda*
- ❑ *F. subaenescens*
- ❑ *F. subintegra*

❑ *F. subsericea*
❑ *F. ulkei*
❑ *F.* cf. *fossaceps* (an undescribed species)
❑ *Lasius alienus*
❑ *L. claviger*
❑ *L. flavus*
❑ *L. interjectus*
❑ *L. latipes*
❑ *L. minutus*
❑ *L. murphyi*†
❑ *L. nearcticus*
❑ *L. neoniger*
❑ *L. pallitarsis*
❑ *L. plumopilosus*†
❑ *L. speculiventris*
❑ *L. subglaber*
❑ *L. subumbratus*
❑ *Aphaenogaster fulva*
❑ *A. mariae*
❑ *A. picea* (a species complex)
❑ *A. rudis* (a species complex)
❑ *A. tennesseensis*
❑ *A. treatae*
❑ *Cardiocondyla obscurior*‡
❑ *Crematogaster cerasi*
❑ *C. lineolata*
❑ *Formicoxenus provancheri*
❑ *Harpagoxenus canadensis*
❑ *Leptothorax retractus*†
❑ *L. sphagnicola*†
❑ *L. wilsoni*
❑ *L.* sp. AF-can (an undescribed species)
❑ *L.* sp. AF-erg (an undescribed species)
❑ *Monomorium emarginatum*
❑ *M. floricola*‡
❑ *M. pharaonis*‡
❑ *M. viride*
❑ *Myrmecina americana*
❑ *M.* new species (an inquiline social parasite of *M. americana*)
❑ *L. umbratus*
❑ *L.* cf. *niger*‡ (this may be an undescribed species)
❑ *L.* cf. *umbratus* (an undescribed species)
❑ *Nylanderia flavipes*‡
❑ *N. parvula*
❑ *N.* new species (an inquiline social parasite of *N. parvula*)
❑ *Paratrechina longicornis*‡
❑ *Polyergus lucidus*
❑ *P. montivagus*†
❑ *P.* cf. *longicornis* (an undescribed species)
❑ *Prenolepis imparis*

Myrmicinae (63 species)

❑ *Anergates atratulus*‡

❑ *Myrmica alaskensis*
❑ *M. americana*
❑ *M. brevispinosa*
❑ *M. detritinodis*
❑ *M. fracticornis*
❑ *M. incompleta*
❑ *M. lampra*†
❑ *M. latifrons*
❑ *M. lobifrons*
❑ *M. nearctica*
❑ *M. pinetorum*
❑ *M. punctiventris*
❑ *M. quebecensis*†
❑ *M. rubra*‡
❑ *M. scabrinodis*‡
❑ *M. semiparasitica*
❑ *M.* sp. AF-eva (an undescribed species)
❑ *M.* sp. AF-ine* (an undescribed species)
❑ *M.* sp. AF-scu (an undescribed species)
❑ *M.* sp. AF-smi (an undescribed species)

- ❑ *M.* sp. AF-sub†
  (an undescribed species)
- ❑ *Pheidole flavens*‡
- ❑ *P. pilifera*
- ❑ *Protomognathus americanus*
- ❑ *Pyramica metazytes*
- ❑ *P. pergandei*
- ❑ *P. pulchella*
- ❑ *Solenopsis invicta*‡
- ❑ *S. molesta*
- ❑ *S.* cf. *texana*
  (an undescribed species)
- ❑ *Stenamma brevicorne*
- ❑ *S. diecki*
- ❑ *S. impar*
- ❑ *S. schmitti*
- ❑ *Temnothorax ambiguus*
- ❑ *T. curvispinosus*
- ❑ *T. longispinosus*
- ❑ *T. schaumi*
- ❑ *T. texanus*
- ❑ *Tetramorium caespitum*‡

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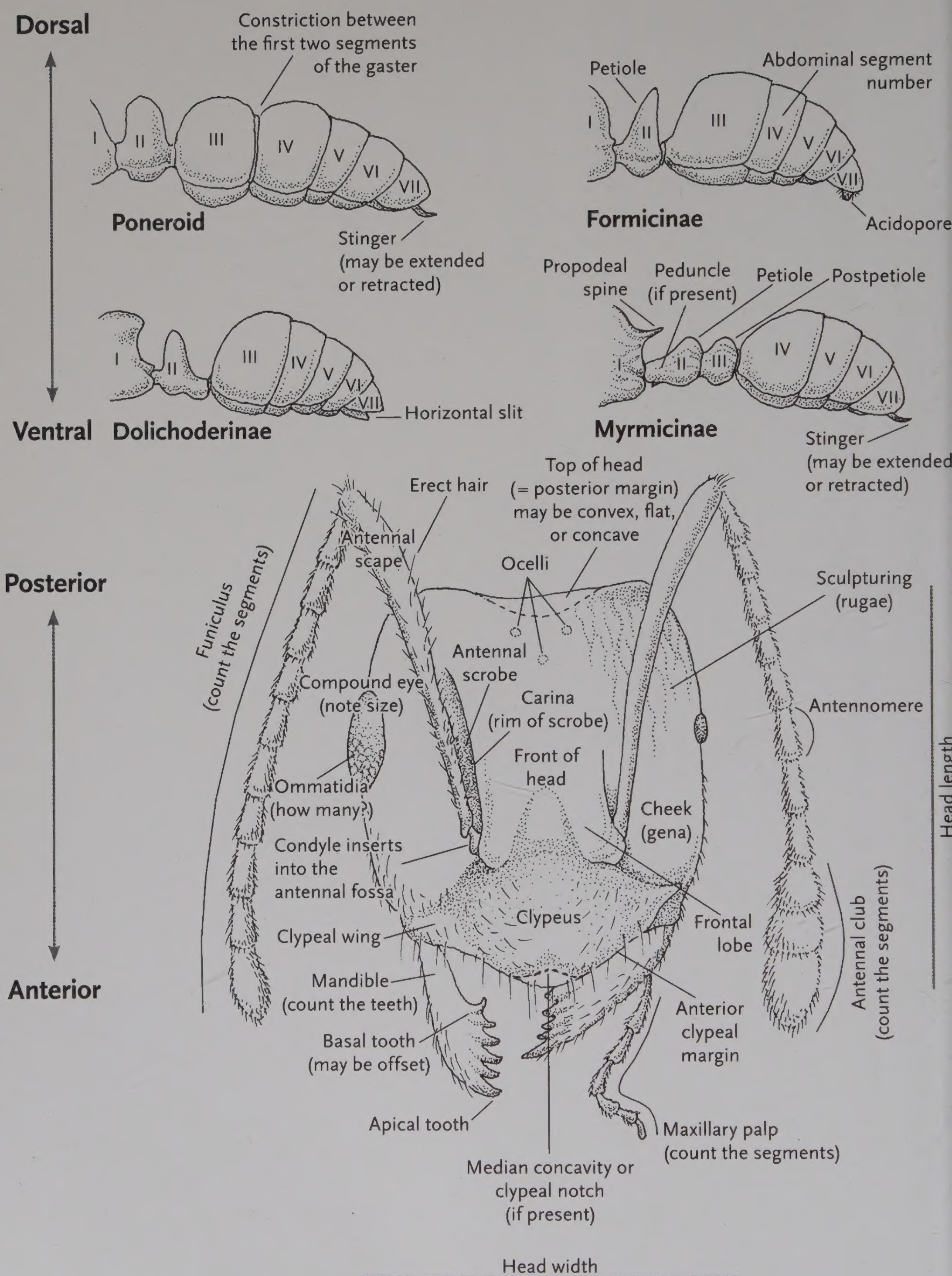
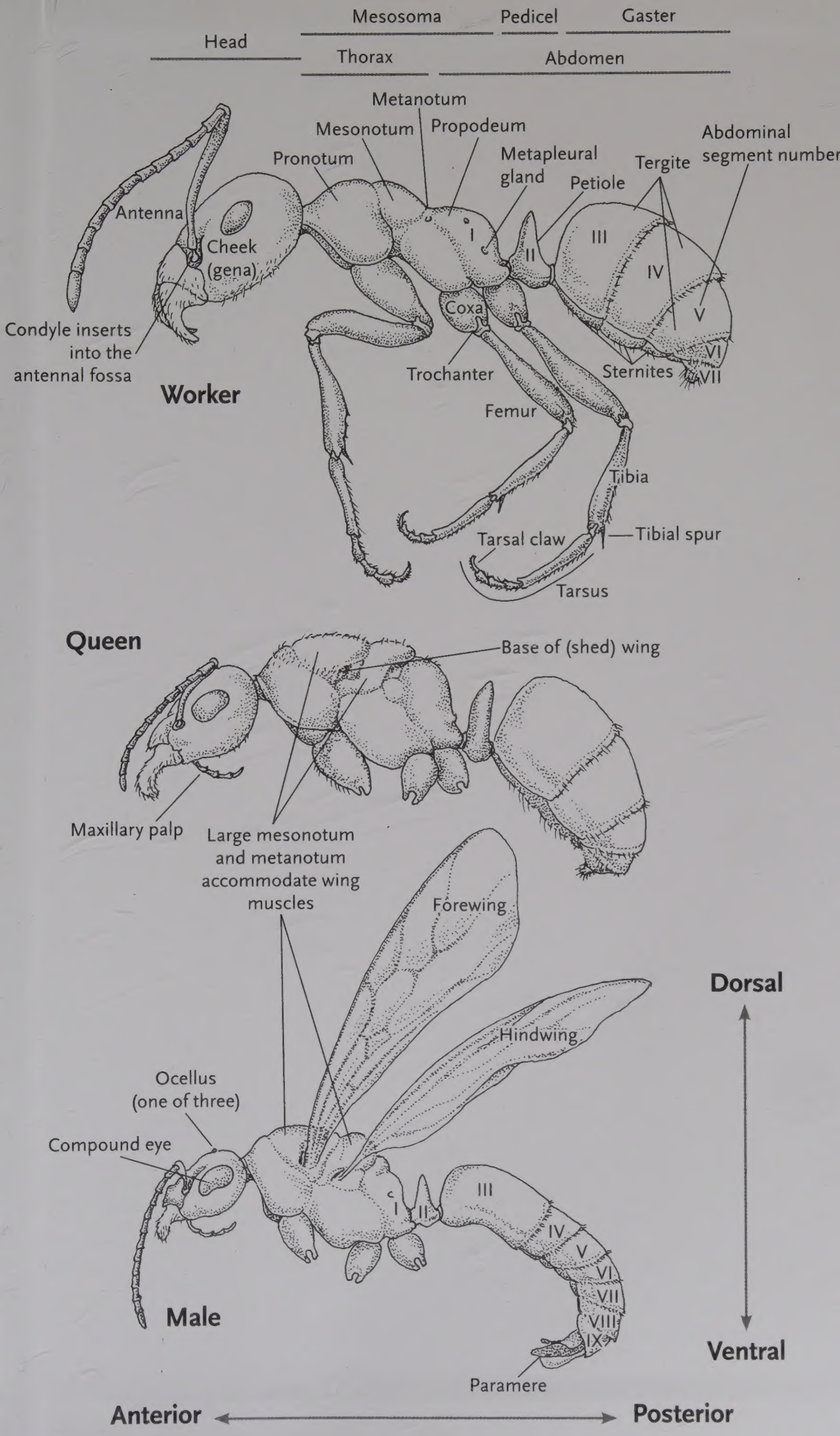


These drawings illustrate the most important body parts and other characters that are used in this book to identify ants. The profiles are idealized, representative drawings that do not depict any particular species. The face is a composite that includes characters of many different species.


Mesosoma
Pedicel
Gaster
Head
Thorax
Abdomen
Metanotum
Mesonotum
Propodeum
Pronotum
Abdominal segment number
Metapleural gland
Tergite
Petiole
Antenna
Cheek (gena)
I
II
III
IV
V
VI
VII
Coxa
Condyle inserts into the antennal fossa
Trochanter
Sternites
Worker
Femur
Tibia
Tibial spur
Tarsal claw
Tarsus
Queen
Base of (shed) wing
Maxillary palp
Large mesonotum and metanotum accommodate wing muscles
Forewing
Dorsal
Hindwing
Ocellus (one of three)
Compound eye
I
II
III
IV
V
VI
VII
VIII
IX
Male
Ventral
Paramere
Anterior
Posterior

"This ground-breaking field guide not only contributes to our basic knowledge of ants, but places the ants of New England within reach of those interested in the natural history of the region."

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UNIVERSITY OF OKLAHOMA

"Will appeal to anyone interested in insects or natural history in general, as well as those who are truly ant enthusiasts."

JANE O'DONNELL
UNIVERSITY OF CONNECTICUT

"This is phenomenal! A fantastic job and will be very usable for all students. I love the natural history and details about all the ants—especially the names! The matrix keys are GREAT and really helpful."

KATHERINE BENNETT
5TH-GRADE TEACHER

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